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Amethyst in a Missouri Sink Hole

by Mrs. Theodore Boente
4980 Neosho St., St. Louis 9, Mo.

Yes, we found an amethyst geode on the dump at the Rueppele Iron Mine, near Stanton, Missouri. It was about six inches in diameter and on the outside looked like a limonite replacement of marcasite. Thinking it was a better pseudomorph than we had found before, we decided to take just part of it, so we hit it with our hammer and it popped right in half. It was hollow and lined with amethystine quartz crystals about a half inch in diameter and some an inch long. Needless to say, we were quite elated. Amethyst had been found before at this particular mine, but most of it is in the museum at the Missouri School of Mines, so we are quite proud of our specimen, because they are rare in private collections.

Rueppele Mine is one of the so called "Sink Hole Iron Deposits" in Missouri. The sinks are quite common in the north central Ozark region. They were formed by the collapse of the roofs of ancient caverns or solution channels. These caves occurred in the Eminence and Gasconade dolomites, and in some cases extended into the Potosi formation. Dolomite rocks are composed of calcium magnesium carbonate which is easily dissolved in ground water. As a result, a great number of caverns have been produced in these formations. The overlying Roubideau sandstone collapsed into the caverns, producing the sink hole structures.

On the surface the sink structure is characterized by a roughly oval or circular area in which the strata dip in toward the center. The ore body in most cases occupies only a small portion of the center, and the ground surface is usually strewn with boulders of specular iron, or "blue ore." The specular iron when fresh is very beautiful. The small brilliant crystals are usually in pockets throughout the massive blue ore or hematite. We have one pocket of crystals about an inch in diameter and right up through the center is a single completely transparent quartz crystal. It is really a beauty.

The ore body of the sinks was originally iron sulphide, marcasite predominating, with lesser amounts of pyrite. The marcasite occurs in plume-like radiating and botryoidal forms, sometimes coated with pyrite. As long as the sulphides were below ground-water level, they were preserved from alteration, but in time, due to an uplift of the region, the ground-water level was lowered. This brought the upper part of the sulphides into the zone of oxidation, which resulted in the alteration of the pyrites to the various oxides of iron, yet preserving the form of the marcasite and pyrite, producing pseudomorphs. The source of the mineralization is believed to have been overlying strata of Pennsylvania sediments which have, for the most part, since been eroded away.

Some thirty different minerals have been reported as being found in the Missouri sink hole structures. Some of the more common ones are quartz, dol-

(*Concluded on Page* 15)

EARTH SCIENCE QUIZ No. 4

Test Your Knowledge! How much do you know? How many of the following terms can you define? They are arranged in three groups with progressive difficulty. Group 1, things everybody should know; group 2, things good "rock-hounds" should know; group 3, things which experts might be expected to know. Try your luck. To score—add up total points as indicated by the group number and rate as follows: 1-6 poor; 7-13 good; 14-20 excellent; 21 perfect. (Answers on page 27.)

a.—(1) geode
b.—(1) graphite
c.—(1) stalactite
d.—(1) carnelian
e.—(1) alluvial
f.—(1) breccia
g.—(2) acicular
h.—(2) satin-spar
i.—(2) ductility
j.—(3) isometric
k.—(3) extrusive
l.—(4) trompe

Unakite Granite of Virginia

by Dr. Waldo H. Jones
Myrtle Beach, S. C.

The beautiful and ornamental mineral known as Unakite is technically a granite being an aggregate of red to flesh colored feldspar, quartz, many tiny crystalline pegmatite minerals and cemented into a filling of beautiful green epidote.

The mineral was first recognized and collected in the high UNAKA Mountains on the Tennessee-North Carolina borders; hence the name UNAKITE from the Mountains of UNAKA, the Hill God of the Cherokee Indians who yet live in those same mountains.

The Unakas unfortunately are remote and hard to reach, hence not too much in the mineral line has been collected from them. However, further North and we hope later to be found further South, in the high gaps of the Eastern Blue Ridges at elevation 1500 to 2000 feet, we find Unakite as great ledges and vugs in the mountain following the pitch of the particular spot it occurs in. This rock is, of course, a fire formed very ancient volcanic rock or let us rather differentiate igneous from volcanism. These great igneous rocks are especially well seen in the George Washington National Forest and the Shenandoah National Park.

My son, George, who is an inveterate follower of the out-of-doors, and I left Myrtle Beach for Front Royal, Virginia, last July to attend a meeting of doctors there. After several false starts we finally got going about 3 p.m. and entered the Valley of Virginia, the Shenandoah, about dark, spending the night outside of Lexington, Virginia, in a nice tourist cabin.

Route VA 56 is a good tar road runs to the left up past the Makite to the Skyline Drive. An engineering Marvel. Straight ahead goes to Irish Creek Tin Mines.

Early the next morning we drove to Steeles Tavern where the first reaper and binder was made by McCormick. This incidently was made from iron mined right in sight of the blacksmith's shop at Vesuvius on the Valley Branch of the Norfolk and Western Railroad. The mines can still be seen there but are shut down.

Turn right off the Valley turnpike onto Va. State Road 56 toward the Blue Ridge and cross the RR at Vesuvius Station. The hill to the right rear of the

The Syenite Facies of the Makite makes enormous boulders 10 to 20 tons. Very beautiful stone. Dype in background left is Makite.

Station has a great manganese mine on it, now long closed (manganiferous iron). Next you go on up black top State Road 56 until suddenly you reach an abrupt twist in the road and the Unakite deposit is right there all opened up for you. A bulldozer has cut into it, blasting has been done and there is enough mineral lying around to fill many railroad trains.

I first saw this deposit in company with Prof. Earl Shannon, U. S. National Museum Mineralogist, in 1926. The road was a sand clay rock road. The trees now lining the road did not exist then.

You feel at first like a pig in a granary and try to pick up everything at once but look things over carefully for there is the vastest selection imaginable. I found several hundred pounds of marvelous gem grade Unakite finely granular, coarsely crystalline, some almost all epidote, an apple green color and gem quality. In the upper part of this quarry we found a thick ledge or dike of unakite penetrating the igneous rocks which had been colored and altered at the contact line to a hard beautiful quality ornamental stone. Using your heavy weight stone buster hammer which is a must here, break off some pieces of this rock and spit on it in the conventional manner of all rockhounds. Take only the best for it all makes you hungry to look at it. Get good sized pieces so you can saw it in smaller pieces for selection of gem materials. Gem rocks are better sawed than broken.

Leaving this quarry site the hill rises terrifically before you and with the mountain on your left and the valley of the Rose Creek on the right, wind your way around the mountain until suddenly you come out into a magnificent gap on the top of the Blue Ridge toward Montebello Post Office.

However take your time for every few yards up the mountain you will encounter ledges of Unakite and its various facies sticking out of the mountain, naturally not as fresh as that in the quarry face.

On top of the ridge the road turns toward the South and the Irish Creek Tin Mine Road off of the Skyline drive. Turn left into the Skyline drive.

However we turned toward the North down the Blue Ridge Parkway on the magnificent engineering work called the Skyline Drive. This road is a thing of pristine natural beauty and engineering magnificence having been carved out of the Blue Ridge's highest parts. At the time this was first pro-

jected the writer had travelled most of the passes thru the ridges which average 3000 ft. elevation, and the situation was a sorry one indeed. The timber was all cut down, the game killed off, the brush had been burned through careless fires and to grow grass for cattle culture. All this is now changed. Nature has taken over again with the judicious aid of the National Park Services and is well controlled and cultured. The game has returned and they are planting fish again into the the rivers and creeks.

We entered the Shenandoah National Park finally and paid our tiny toll charge (25c). Here we find a development far exceeding that of the George Washington Forest and here and there are great overlooks arranged to furnish views for the visitors of the various gorges and the valleys of the Shenandoah's Rivers.

Here at Rock Point Overlook we found vugs and lenses and ancient fire formed fumaroles in the rock lined with crudely crystalline feldspar and masses of Unakite. The drop to the left background here is nearly 2000 feet to the higher valleys of the Eastern Shenandoah Valley and its limestone ridges and mountains. This western side of the Blue Ridge is where we find the great deposits of iron and manganese minerals, on the contacts between the igneous rocks of the mountain province and the valley limestones and shales.

Further down the Skyline Drive we find a great engineering feat of tunneling thru a mountain on a flat level thru tremendous Marys Rock which separate the eastern side of the mountain from the western over-ledges of the Shenandoah. It is called the Marys Rock Tunnel. I stopped and examined these rocks and found them a typical green stone with several granite facies well developed.

Leaving the Marys Rock Tunnel we finally reach Thornton Gap where the road to Luray and the Valley crosses the Skyline drive. But our road was further along the ridges and we finally reach the Front Royal entrance of the drive and our destination.

I stayed at the meeting for three or four days, lecturing five times on minerals and various phases of minerals and chemicals derived from them and their relationship to mankind and life.

Leaving Front Royal we went thru Luray and the village of Stanley where we crossed the North Fork of the Shenandoah River—a truly beautiful and profitable stream. Just across the

This was our most interesting view. The funny snake shaped object on the greenstone is a fumarole lined with Makite Crystal Masses. Skyline Drive, Shenandoah National Park.

bridge we spied a magnet for a mineralogist - geologist, a big rock quarry. This is being operated for the Virginia State Highway Department and was full of brecciated limestone with lenses, vugs and seams of crystalline white to colorless calcite. In all we stayed there two hours and collected a lot of specimens for our rock pile at home. This rock fluoresces a silvery yellow color in the calcite and a reddish purple color in the dolomite limestone.

The Unakite—to return to this subject—fluoresces purplish and sometimes has reddish spots which upon closer examination are found to be admixtures of the various pegmatite minerals. It is mildly radioactive probably from inclusions of thorium minerals, tho various uranium minerals have been reported from time to time in the Virginia areas.

We finally arrived home early next morning as the saying goes, sunburned, windblown, hungry, weary, and happy and I might add "broke."

But the trip was a most profitable one scientifically and culturally and we enjoyed every second of the time spent in the field. On the road home we passed several large operations which time did not permit us to examine—a large limestone quarry, a deposit of fullers earth now inoperative and along the roadside great quarries being operated for the purpose of obtaining road metal. These trips into Virginia and North Carolina if well planned are a profitable and interesting thing. Take rough clothes and no non-essentials of equipment as you will need the space for rock and minerals, and a couple of jugs of water to be safe.

A trip with a copy of Thomas Leonard Watsons' Minerals of Virginia could and would be a most profitable thing indeed. Even tho many of the mines are today closed down, there are tons of minerals to be had for the taking. For example in Louisa County there is a great sulfur mine, iron pyrites. In Nelson County we find the great Soapstone Quarries, in Buckingham County we find the tremendous quarries for roofing slate and such things.

No story about Virginia would be complete without a tale about a cavern, for the valley of Virginia abounds in great natural caverns. Those at Luray and New Market are very well developed and fine but at Front Royal we find Skyline Caverns. Then down at Harrisonburg the great Endless Caverns—mostly only a fourth or a half explored.

However, in examining any wild caves, be very careful. The commercial ones have been pretty well protected and cleaned out of danger but the wild ones are something else. I examined one a few years ago in which I had to crawl on my stomach to get anywhere. Then suddenly a great room opened up in the back. The farmer used it as a root cellar and meat storage house. My ambition is to own a cavern.

I truly believe that anyone interested in Earth Sciences should visit the Old Dominion and see Virginia's towering mountains and fertile valleys along the North and South Forks of the Shenandoah.

Incidentally, if not checked, the Shenandoah instead of flowing to the north into the Potomac at Harpers Ferry is about to start flowing east into the James River valley thru erosion of the ridge of the valley rocks. However don't worry too much about it as we estimate it will take 25,000 years at present erosive rates. We would be pretty old by then.

Virginia has fair hills, fine farms, excellent food and pleasant attractive people, and great hospitality to the traveler. It is the greatest apple producer of the eastern states. Near Winchester are thousands of orchards. In all you can have a lot of fun in the Old Dominion.

* * *

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The Changing History of the Insects

by Burke Smith
205 Randolph St., Oak Park, Ill.

If the number of species of an animal group is an indication of the biological success of that group, then we must concede that the present age has belonged to the insects. In spite of their small size, insects make up three-fourths of all known animal species, and the number and variety of their living place is almost beyond imagination. Consider the order of beetles, for instance, which has more families, genera and species than any other comparable group of living things in the shapeworld. There are beetles specialized to swim under water and on its surface; some have become flattened in shape to live under the bark of trees, or have developed special mouth parts for boring into posts and logs; others are rapid fliers, spending much time in the air searching for insect prey; a number live as guests in ant nests; a few have lost their eyes and coloring and live in caves. There is even one small beetle, *Anthrenus museorum*, which specializes in invading the boxes where dried insects are stored in museums, and devours the prize specimens being studied by entomologists!

In many less esoteric ways, insects have been remarkably able to take advantage of man-made changes in the environment. Many became disease carriers and farm pests after man destroyed their natural haunts, or eliminated the enemies which formerly held them in check. Although it does not appear likely that man, who came into a world already well stocked with insects, will be displaced by them, it is an open question as to whether he will have to adjust to their presence for ages to come, or whether he can subdue them as he has many other forms of life. Certainly the use of new insecticides has not yet sent flies or mosquitos down the path followed by the Great Auk or the Passenger Pigeon to extinction.

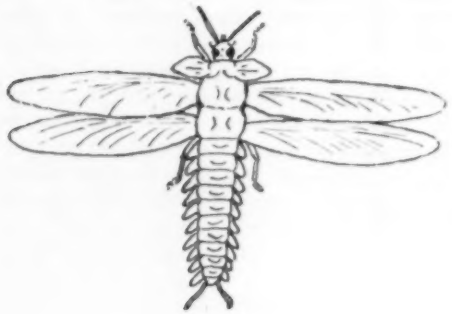
Perhaps a look at the past history of insects may give us a clue as to what to expect in the future. Insects have been around ever since the Devonian era, which means for about 300 million years. Their fossil record for this vast time span has been very incompletely explored, because being light-bodied, they did not usually fossilize in large numbers. Geologists as a result have neglected the insects and concentrated upon the more numerous or spectacular sea animals and vertebrates.

We have only a single doubtful fossil from Old Red Sandstone in Scotland which may be the earliest insect — a wingless creature, not too far removed from a trilobite in appearance except that he had only three pairs of jointed legs and lived on land. There are about four hundred fossils to prove the existence of primitive winged insects in the Pennsylvanian, some 40 million years later. This was during the warm and fecund time of the coal forests whose lush swampy growth evidently agreed with the cockroaches, who to this day thrive on steam heat. Cockroaches were big in those days — some almost six inches long — and numerous. So many of them have been described from the Pennsylvanian that the era is sometimes called the "Age of Cockroaches." Other insects of the Pennsylvanian were large by comparison with their modern descendents. This is not surprising, as our largest insects today abound in the tropics where it is perpetually hot and humid.

It is somewhat startling to find imprints in French Commentary coal deposits of a giant dragon fly, *Meganeura*, with a wing spread of twenty-nine inches. Such a creature, the largest known insect, if alive today would no doubt be able to feed voraciously on sparrows and other small birds. However the first birds arose from a small dinosaur reptile almost 100 million

years later in the Jurassic, and no bird's song penetrated the dim silence of the eerie tree-fern forests of Carboniferous times. In the absence of birds, there were other primitive insects flying clumsily about to supply food for those giant dragon flies.

It was an insect who first achieved the miracle of flight. We can imagine how this may have come about when we examine the structure of the primitive Pennsylvanian winged insect *Stenodictya*, long since extinct. This animal had two pairs of long, membranous wings, which because of their way of attachment, could have moved only up and down. In front of the wings on the shoulders or thorax of the creature, was a pair of smaller projections which looked like small rigid airplane wings. In back of the membranous wings, and sticking out of each side of the abdomen were two rows of flaps which could have acted



The World's First Flying Machine--- Stenodictya, about 280,000,000 years old

as elevators or depressors in the same manner that the tail wings regulate the upward or downward flight of an airplane. The large wings have started on their course of evolution as nothing more than two pairs of these wing flaps embellishing a wingless ancestor of early Devonian type.

We need never expect to see an insect as large as a man, for the insect giants of the coal forests had probably reached the maximum size permitted to an insect body. With no bony skeleton inside, an insect must move by muscles attached to its outer horny skin. The larger the insect, the thicker the armor it must carry to support the body weight. A man-sized insect would presumably encounter the same difficulties as did knights of the late Middle Ages in Europe, who were so encumbered they had to be hoisted on to their warhorses by derricks.

Insects have never quite solved the problem of how to grow out of their rigid outer covering without danger to themselves. The method they use is to grow a new coat of flexible skin within the old, then to split open the old coat and climb out of it. They next expand the new flexible coat to fit their increase in size before the skin hardens into inflexible armor again. The process of shedding armor, or molting, is a crisis in the life of every insect to this day. He exhausts himself in climbing out of the old coat, runs the risk of hardening in a misshapen form if conditions for inflating the new coat are not right, and cannot run away from his enemies while the new coats are soft. What would happen if an insect as big as a man tried to molt? On land at least, weighed down by sheer bulk, he would lose his body shape and his new outer coating would harden into a lethal strait-jacket.

During early Permian times, some 235 million years ago, it almost seemed as though insects began to realize the advantages of smaller size. Although dragon flies remained large and primitive Mayflies were common, a number of new groups arose which were small, some nearly microscopic. Many thousands of fossil insects found in Permian rocks near Elmo, Kansas, reflect the trend toward reduction in size and new types such as beetles, unknown in the Pennsylvanian, began to appear.

When an insect becomes small, the Achilles' heel of the molting process is offset by the many advantages an armored coat confers on the wearer. It is very convenient to fit snugly inside a tough, hard shell which shields you from the blows of the world and at the same time is thin enough at the joints to enable you to run, fly or swim by the

use of muscles many times stronger by comparison than those of a man. And if this outer shell also helps to keep you from drying out when the world becomes a desert, its value increases many times over.

For during the close of the Permian period the world became a hard place for animals who were used to the easier living of the coal swamps and shallow seas which had been their home for so long during the Carboniferous. The tremendous upheavel of the Appalachian Mountains rocked the continental masses to their foundations, and brought about a change in climate. Many of the seas became dry land. The dry land became drier, and large deserts appeared. Glaciers formed, and expanding mountains of ice added the menace of cold to the forbidding scene. During such times animal groups which had existed for hundreds of millions of years perished. Among the missing at the close of the Permian were distant relatives of the insects, the trilobites and the sea scorpions, who had once dominated the seas.

The insects weathered the storm and especially in the case of the beetles, spread out rapidly into new living places on the depopulated land when the climate gradually became moister and milder in the Jurassic. Perhaps it was the glacial cold of the preceding Permian times which led insects to invent a new way of life releasing them forever from dependency upon the continued heat of the tropics. In any event, they began to withdraw into a protected cocoon or pupa during cold weather, before making the last molt into an adult. The full-grown insects which came to differ more and more from their young as ages passed, emerged with the return of warm weather and started each new generation under favorable auspices.

Some of the best fossils of the period come from the famous Jurassic lithographic slates near Solnhofen and Eichstadt in Bavaria. Flying insects which fell into the quiet waters of lagoons in the area were quickly but lightly covered with a fine limy sediment washed in from surrounding reefs. Under such conditions, even glossamer-winged flies were preserved to perfection. Jurassic fossils found at Solnhofen and elsewhere are those of quite modern insects. Beetles and true flies were common and other highly developed orders — moths, social ants and termites — appear on the stage for the first time. All of the insets just mentioned except the termites took advantage of the cocoon or pupa stage whereby the young change from a worm or grub into an adult which has completely shed its youthful figure and habits. For example, a caterpillar furnished with leaf-eating jaws spins its cocoon and emerges transformed as a moth with tube-shaped mouth parts fitted only for sipping the nectar from flowers.

It was during the Cretaceous period some 140 million years ago that flowering plants and butterflies became abundant. From that time on, insects began to carry the precious pollen which insures fertilization of the plant egg and the development of fruits and seeds. To attract flying insects in their vital work, flowers have ever since brightened in color and advertised their nectar with sweeter perfumes. We sometimes overlook the fact that to destroy all flower-visiting insects would be to end our most valuable fruit crops and our most beautiful flowers, which add so much to the richness of the modern world.

The Mesozoic age, composed of the Triassic, Jurassic and Cretaceous eras, is usually called the Age of Reptiles because of the spectacular rise of the dinosaurs, culminating in that huge nightmare of ferocity, *Tyrannosaurus rex*, the largest flesh-eating animal ever to walk the earth. However, in spite of all the sound fury of the reptilian drama, it was the insects who endured to inherit the earth, together with the mammals. For about 70 million years ago, when the Mesozoic came to a close in another one of those gigantic upheavals of the earth's surface which again changed the climate, it was the dinosaurs who became extinct with an overwhelming completeness and left

nothing but fossilized tracks, bones and eggs to posterity. This was the time when the Rocky Mountains arose in a climax of vulcanism and glaciers renewed their advance over surrounding lands. The insects survived the crisis without noticeable losses and continued their evolution. The earliest fossil beds of the Cenozoic contain the first record of those most highly developed of all social insects, the bees.

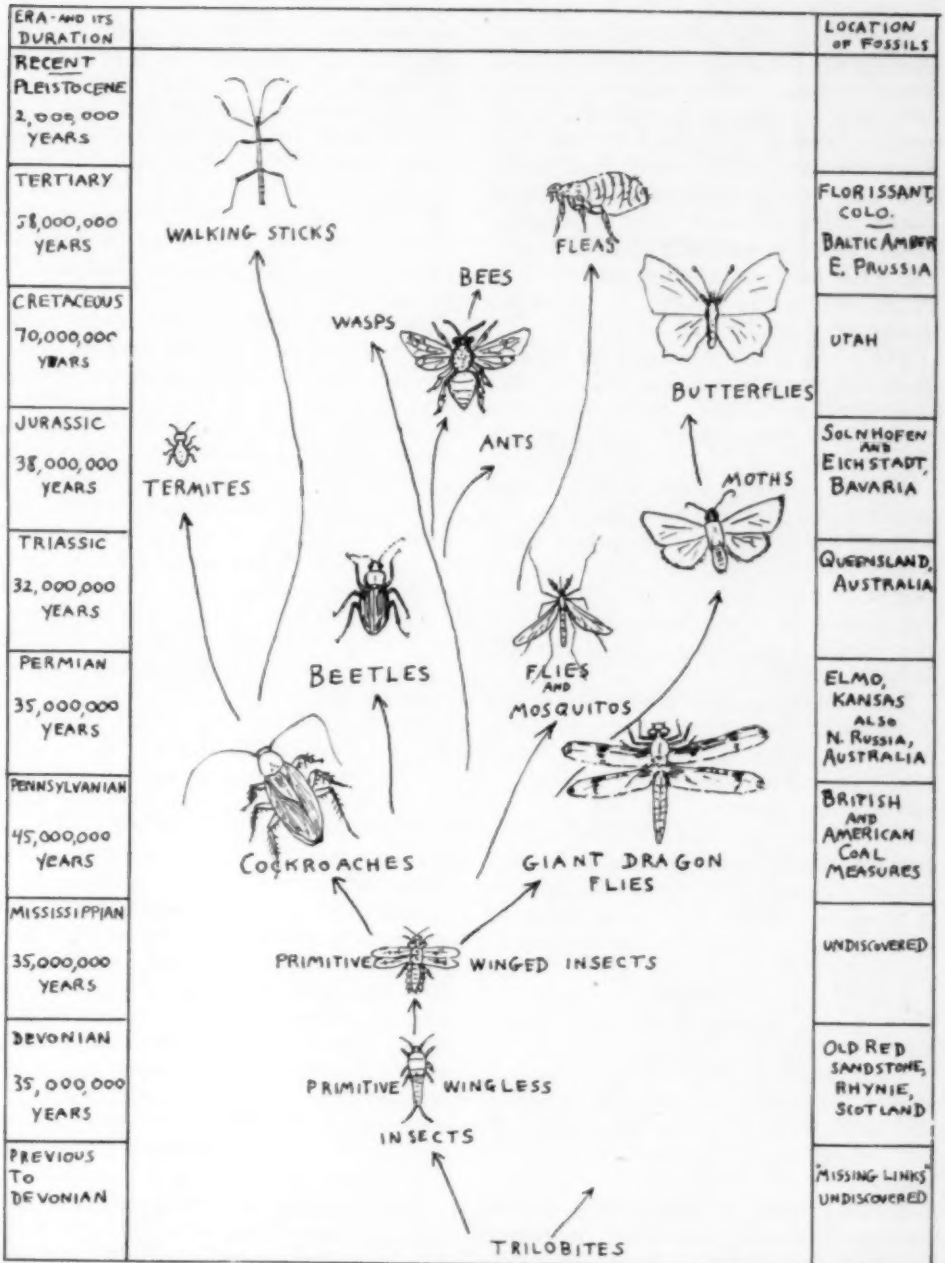
Together with ants, wasps and termites, the bees had already perfected their societies at least 70 million years before the first human civilization arose in the lower valley of the Tigris-Euphrates. Only in the past six to ten thousand years has man surpassed these insects in social organization. It looks as though he has finally beaten them at their own game however, for the civilizations of men have touched a new level of evolution, that of written language, science, art, and morality.

Insect colonies exist only because their members act as instinctive machines geared to the preservation of the nest, and are doomed to remain forever in the blind alley of totalitarian economy. Furthermore, lacking hands and an imaginative brain, insects cannot invent, fabricate or manipulate tools with human skill, and are stopped dead at the level of a hunting or farming society, however much they may perfect adjustments within that frame. Man, on the other hand, has in the incredibly brief period of recorded human history, built a number of civilizations of amazing complexity, the best of which have given him the means for continued growth in the realm of the human spirit.

Even outside the field of social development, there is some question as to how long insects will continue to expand in a world dominated by man. Only a few major insect groups have originated since the Eocene, among them the walking stick insects, a recent specialization from the old cockroach stock, and the fleas, who may be related to the flies, exploiting a parasitic type of life opened up by the presence of fur-bearing mammals. Both date back to the Oligocene of Tertiary times, from which era we have the most complete and perfectly preserved insect fossils in existence, imbedded in amber washed up from the Baltic Sea. Once this region was a pine forest, and the pitch oozing from the trees served as natural fly-paper to trap thousands of forest insects. When the trees finally rotted away, the pitch solidified into amber, and small pieces with insects encased inside are washed up on the East Prussian shores to this day. When cut and polished, the amber is as transparent as a window, and shows every microscopic hair of the tiniest gnat trapped inside. Such insects can be studied and compared in detail with their live counterparts of today. In order to find out what changes had occurred since the time of the Oligocene pine forests, scientists set out their own fly paper and trapped insects in the pine forests of New England which resemble closely the forests of long ago.

They concluded from their research that many common groups of insects may have already seen their best days. For example, there are more flies in the pine forests of today, but ants seem now to be only one-ninth as plentiful. A black ant identical with a species found in Baltic amber is alive to this day, indicating a fixity of structure and resistance to change which does not look promising for its future. Perhaps the insects are beginning to lose some of their evolutionary drive and adaptability and will give way more and more to the changes man can make in the world of the future if he solves some of his own contemporary social problems. (*See chart on page* 11).

How Some Well-Known Insect Groups Originated*



* NOTE: CHART SUBJECT TO CHANGE WHEN MORE INSECT FOSSILS ARE FOUND

Steps to Lapidary Success

by Kenneth Russell

President, Marquette Geological Association

Gem cutting calls for manual skill, coordination of eye and hand, and some artistic sense. The former is learned by practice; the latter can be cultivated. Artistic judgment is the first talent which the gem cutter must bring into play in the process of shaping a rough piece of stone into a pleasing jewel. This is especially true in working with such decorative materials as agate, where the charm of the stone lies in its pattern and color.

First of all, do not waste any time on unattractive or flawed material. Be sure the rough slab, as it comes from the saw, is free from cracks, soft spots and the like.

Having chosen good material, the problem becomes one of using it to the best advantage. The gem cutter must work with what is in the stone; he can be creative only in the sense of framing and accentuating the best qualities of the rough gem material in the finished stone.

Some rough is gem material because it contains a design. This may be a flower or spray, as in Priday ranch agate, or Montana moss agate, a fortification pattern, or an eye or other oddity. In bringing out a design to the best advantage, it is customary to center the design or picture to produce balance, such as is achieved in a formal garden. The design should dominate the total area of the stone but should not be crowded; it should be framed as a picture is framed, with a matt of neutral material around it, if possible. The total effect, however, should have unity, a center of attention that attracts the eye to the design itself and does not distract it with details.

As a practical matter, it may also be necessary at the beginning to decide whether the design can be best displayed in a flat or a cabochon stone. Some designs are distorted by a domed or cabochon cut; others, such as tiger-eye, are only effective cut that way.

Some gem materials have an all-over pattern rather than a design, and they should be cut so as to have an even pattern covering the whole surface of the stone. In this way unity and balance are achieved. The small evenly spaced dots of red in the green matrix of bloodstone are an example of this type of material.

In all gem stones color is desirable and always plays a large part in forming the design. Color must be considered in attaining balance and a center of interest, because it is often the first element that catches the eye. Some materials, such as Texas agate, may be such a riot of mixed color that all definition of pattern is lost and the effect is dark, muddy and unpleasing. In such stones, try to find areas that are less embarrassing in their profusion of pattern, so that design can be seen against a background area of neutral chalcedony or jasper.

The possibilities of a slab are often not apparent at first glance. When this is true, put the slab aside and let your eye work on it until some pleasing combination of color and design is apparent or until the slab is seen to be worthless.

One of the best mechanical helps to composing a design or pattern on the rough slab is the templet, which is a thin flat plate of metal or plastic containing a series of ovals or other shapes in standard sizes for cabochons, hearts, etc. The holes are commonly ovals marked with their width and length in millimeters, as 8mm. x 12 mm., which are standard for fitting in jewelry mountings.

The best type of templet for the amateur is made of translucent plastic. It can be moved over the slab to try out all possible areas from which a stone might be cut, until the most pleasing

comes into view, as in a window hiding the rest of the slab.

If the slab is a large one, mark out a series of stones before you begin to saw. Marking is done with an aluminum pencil, which is simply a stiff aluminum wire or small rod sharpened to a point. When this is scribed around the inside of the templet opening it leaves a silvery line that does not readily wash or rub off while the stone is being cut and shaped. Be sure to leave enough space between stones marked on the slab so that saw cuts can be made between them.

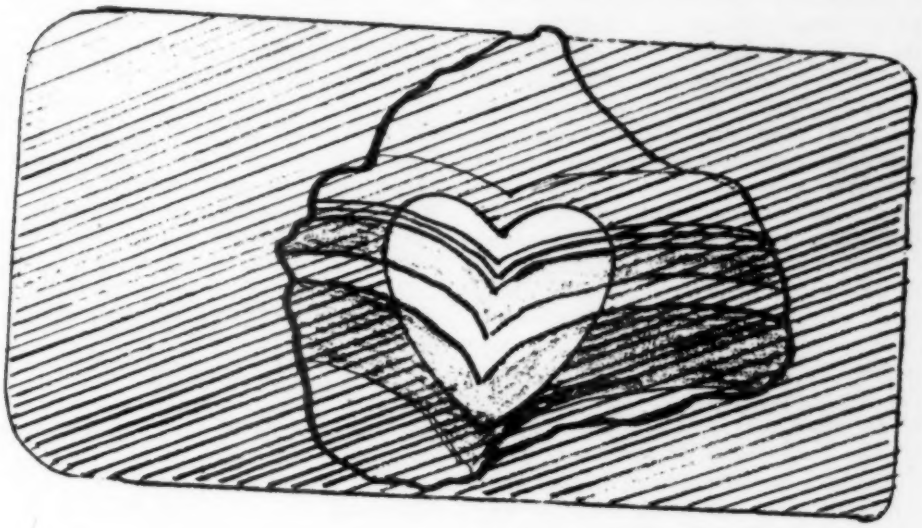


Illustration showing how Semi-Transparent Template gives opportunity to see entire Slab.

The rough slabs are usually cut up into cabochon blanks on a trim saw, which is an arbor carrying a diamond edged blade running in some coolant. A trim saw costs from $30 to $60. The more expensive have roller bearings and will run true longer than the cheaper ones with babbitt bearings. An eight inch blade is usually sufficient to cut any slab, although for sectioning opal or other valuable material a tiny blade may be employed. Such thin blades must have comparatively large collars to give them rigidity and will cut only a short distance. The eight inch blades are made in light duty, standard and heavy duty thicknesses, depending on the width cut desired. Any of these blades will give about the same amount of service, as they contain approximately the same amount of crushed diamond in the notched periphery.

The notched blade is the most practical for the amateur, as it is relatively cheap and gives good service. The sintered edge blade, in which metal and diamond dust are fused together in the rim of the blade, is long cutting but expensive and may break if not used properly. A plastic blade with diamond bonded into the edge is more pliable than the sintered blade, which is made of mild steel or copper, and is especially adapted to sawing costly materials and in sawing piezo-electric quartz crystal.

The trim saw is usually run at moderate speed and in a coolant of soluble cutting oil or the standard ⅔ kerosene and ⅓ machine oil. The slab is held flat on the table of the saw and pressed firmly against the revolving blade, care being taken not to twist the stone, which will bind the blade and strip the set from its edge. Care should also be taken not to force the stone so much that the blade jams in the cut and not to saw too close to the marks, inasmuch as there is a certain amount of chipping and shattering along the bottom edge of the saw cut.

Sand Casting for the Amateur

by W. A. Briggs
305 N. Brainard Ave., La Grange, Ill.

In a previous issue we described the tools and equipment necessary to do sand casting. Now we shall endeavor to describe the actual process of casting, in sequence, so that it will be easy to follow thru.

The first necessity to cast a ring, of course, is to have a model with which to make an impression in the sand.

Apply two or three layers of wax paper from the roll in the kitchen to the 2" x ¾" mandrel. Secure the paper by running the hot modeling tool along the seam. Now heat the modeling tool with the alcohol lamp and apply it to the hard dentalwax. Notice how the spoon end fills with wax. The wax is now applied, hot, to the cylinder and the ring formed. After so long a time you will have an arrangement on the mandrel which actually looks like a ring. You will be surprised at your progress after some practice. Remember to make the model in a generally pyramidal shape so that there will be no undercuts or overhangs to pull out the impressions in the sand.

The half round cylinder is placed on a flat surface, sprinkled with lycopodium and the 3" x 2" cylinder centered over it. This is now thoroughly packed and tamped with the prepared sand and the top levelled off. After packing, pick it up and remove the half cylinder by gently tapping. It generally falls out of its own weight.

With the impression side of the cylinder up, it is placed on the same flat surface. The mandrel containing the ring model is then placed in the impression you just made, bezel up. Sprinkle with lycopodium and fit the other 3" x 2" cylinder over the model and pack thoroughly with sand. Separate the two halves of the flask, remove the ring mandrel by gently tapping and you will see the impression of the outside of your ring.

We now make several small holes thru the top or bezel part of the flask with the jewelers saw blade to relieve gas pressure created when the molten metal comes in contact with the glycerine in the sand. In making these holes use care as the blades are thin and bend easily. They should be pushed and pulled clear thru the flask.

In the other half of the flask we now make a sprue hole by taking a smooth round piece of metal, about ¼" in diameter and pushing thru the sand. Be sure to push against the flat surface until it is almost thru, then you can pick it up and push on thru. Then turn this half over and make a funnel shape hole in conjunction with the sprue hole, making a path for the molten metal, into the impression.

Now we make a core to fill up the inside of the ring. The 2" cylinder which just fits OVER the ring mandrel is filled with sand and tamped thoroughly on a flat surface with a piece of dowel rod. Then it is pushed out and this core gently placed in the bezel portion of the flask.

After seeing that the core fits and that there are no particles of loose sand in the impression, the flask is assembled again. Raise one side of the flask by placing it on the round piece of metal you made the sprue hole with.

Without going into intricate details regarding methods used in determining the proper amount of metal to melt let us say that sufficient metal should be used to make the ring and button—approximately the amount contained in four Mexican quarters.

The crucible should now be prepared by melting borax in the inside and spreading it to all the surfaces in the lower half, by tilting it in the proper direction.

Place the metal in the crucible and heat to about 1400 degrees. This heat will be indicated by the metal looking and acting like quick silver upon shak-

ing and by the flux "spinning." When this point is reached, keep the flame on the metal and pour,—*all at once and rather quickly*. Put the hot crucible on the asbestos pad.

Open the flask, remove the metal and you have a ring. Simple, isn't it? True, it needs work in cleaning up and polishing but the thrill of seeing an idea of yours in precious metal, is something one never forgets. You experience this same thrill with each casting.

Cut the seat, file the bezel, fit the stone, turn over the bezel, file again and polish and you have a keep sake or present any one would be proud to own.

* * *

GENERAL WORKSHOP NOTES

Soft solder may be dissolved from fine gold or high karat gold by immersing in hot hydrochloric acid, in a pyrex dish. Scrape off all you can, with a pocket knife, without scratching the finish underneath. Watch carefully as time required depends on the thickness and composition of the soft solder.

* * *

To protect teeth of fine saw blades and to make sawing easier, run the blade thru a piece of beeswax.

* * *

Rosin, sometimes used as a soft soldering flux, leaves a hard-to-remove coating. Full strength acetone will remove it.

* * *

NEVER POUR WATER INTO ACID. RATHER POUR ACID INTO COLD WATER, WHILE STIRRING WITH GLASS ROD.

* * *

Talc, graphite or lycopodium are good parting powders, when used in sand casting.

AMETHYST (*from p. 2*)

omite, ankerite, barite, copiapite, marcasite, hematite, goethite.

Most of the large sink holes have been mined and are now abandoned. There is still a lot of iron in some, but the working gets dangerous when the sulphide zone is worked, and eventually must be abandoned. The sink hole deposits to us are one of the most interesting features of Missouri.

SAFETY FIRST — THANK YOU!

Comments from alert readers about the shock hazard of Mr. Lulling's setup (Sept., p. 25) are discussed in Mr. Farr's letter below. We appreciate these and will also appreciate any future comments where questions of safety are involved.—ED.

Mr. B. J. Babbitt, Editor
Earth Science Digest
Dear B. J.:

With respect to the comment relative to Mr. Lulling's little article, compliments are in order for the persons who brought up the point concerning safety. No doubt if Mr. Lulling had shown the wiring to his motor he would have included a ground wire from the motor frame.

It is recognized safe practice to connect the frames of electric motors to the earth through water pipes which go far away into the earth or through ground stakes driven down into permanent moisture.

In case of insulation failure in electric motors, lamps, etc., their frames may become energized with electricity seeking a path to the earth. The shock hazard in this case would be reduced and probably eliminated if the frames were connected to ground by a good healthy electric wire, conduit or BX solidly connected so as to make good electrical contact to ground. In the case of portable equipment the wire from the frame is carried along as an extra conductor in the extension cord and the plugs and sockets have extra contacts to make the ground connections.

Just to clear up one little point that might be in the minds of some, it isn't the proximity of the water pipe that increases the hazard in this case because this water system is not connected to the earth. The only contribution this water system might make to the shock hazard would be to get the floor wet where the operator stands.

J. E. FARR, *Chairman*
Earth Science Club of Northern Ill.

New Beauty From Rock

by Dorothy G. Young
733 E. Columbia, Colorado Springs, Colo.

Our rock hobby, shared by our family of three, brings us new interests, joy of service, renewed zest for living. But let me start from the beginning. We were a family of four when our younger son, Morris, became interested in rocks. He was only six, but he was constantly questioning me. "What is this rock? See this pretty rock. What is it?" To try to answer his questions I started reading some books from the library, became more interested, visited rock shops, went on hikes, and our collection was started. One day I took my boys to Colorado College to see their rock collection and we were entranced. A laboratory class was identifying rocks chemically and with the blowpipe and my older son Stanley was thrilled. "I didn't know rocks had chemistry!" he exclaimed. Thus the rock collection became not "Morris' collection" but "our collection" and outgrew its cabinet.

By this time Morris was ten and in an incredible accident which is not part of this story, our son was drowned. Of all his possessions, his rocks alone seemed to hold some continued promise. I thought of the eagerness of other children to learn of rocks and how most of their parents were not able to help them. I also remembered that my daughter, now grown and married, had been interested in rocks as a child and had gradually given it up in frustration of not being able to find anyone to aid her. Morris had interested other children in rocks. Our family could now go on with this collection and have the definite aim of helping and teaching other interested youngsters about rocks.

The first thing that we did was to buy an ultra-violet "black" light and some more fluorescent rocks for we had only a few at that time. We arranged our new rocks in a large box and Stanley brought in a Cub Scout den of which he was a Den Chief, to see the rocks. I will never forget those first "Ohs" and "Ahs" from those boys on their first sight of the new beauty of those rocks! When they left, each boy was going to have a rock collection!

I was anxious to do something further to interest and draw the children, so I powdered some of the fluorescent material and experimented on sprinkling this on the freshly varnished surface of a butterfly I had sketched, using different kinds of adhesive to attach the powder. When I made my first successful butterfly and it fluoresced beautifully under the ultra-violet light, I did a little dance of joy, and thought—why not a picture?

This was the start of my powdered rock pictures which cause a great deal of interest and enthusiastic commment wherever I show them. I exhibit at Art Shows, Mineralogical Shows, and am

"Painting with a spoon."

"Pictures of Rock with Rock."

asked by clubs and organizations to make talks on our rocks and my pictures. These pictures are made entirely of the natural powdered rock, no other coloring agent being added. The rock is attached permanently to canvas or poster-board by a colorless varnish preparation. Copper ores furnish the blues and greens, iron and mercury ores the reds, sulphur and arsenic the yellows. Manganese gives a pure black and calcite and gypsum an easily powdered white; these in combination with many others give many varied hues. Some of the pictures contain an added fluorescent rock powder, which gives a beautiful and realistic sunset effect under the ultra-violet light. The pictures have the appearance of oil paintings at a distance, but the texture of the powdered rock gives them a natural velvety effect. I powder the rock with a large metal mortar and pestle, sift it, using only the fine powder, and apply it with a spoon to the freshly varnished, sketched picture. The wet varnish catches and holds the powdered rock, which, when dry, is as permanent as oil.

Meanwhile our rock collection goes on. We have a rock room to which comes a constant stream of Cub Scouts, Girl Scouts, and just interested youngsters and adults. When the schools are studying rocks I get calls to bring mine to the school-room and to tell the children about them and help identify the ones they have collected. We are setting up lapidary machinery which is my husband's special branch of the hobby and will soon be teaching older boys to cut and polish cabachons. Every trip we take is made more interesting watching for rocks. I could spend all my time on my rocks and pictures, but the real thrill is still the chorus of exclamations I get from a group of children on their first glimpse of the beauties of the fluorescent rocks, or after a talk at school when the children cluster about me to learn more about rocks even though they have been dismissed for recess!

I often think of the truth one youngster most aptly expressed after he had seen our rocks.

"Y'know, rocks are a good collection, you never quite get all of them!"

Earth Science Offers New Frontiers in Education

by Dr. Ben Hur Wilson

Chairman, Board of Governors, Earth Science Digest

In every age and generation we hear frequently expressed opinions that we have about reached the ultimate, and that there are now few more worlds to conquer—"Ne Plus Ultra"—as the saying goes—"The old frontiers are gone."

It seems that this impression—almost a conviction in many instances—is not only true in the world of exploration and settlement, but also often in the field of discovery and invention, and in the realm of culture and education as well. We are likewise sorry to relate that this appears to be particularly true in the matter of science education, especially that of the Secondary Schools, where it has frequently been encroached upon from various angles, practically without resistance on the part of those who should be most vitally interested, the science teachers themselves.

Where early in the century, science and mathematics were commonly the backbone of the High School curriculum, today these important branches are now "pushed around," and frequently relegated to inferior positions to make room for subjects which are often of lesser value, but popular according to the momentary "fads and frills" of so-called modern trends in education.

Earth Science, for example, a subject which early in the century, held a respected position as Physiography in the secondary school program, has now all but disappeared from the high school curriculum. A summary of enrollment in Earth Science in the public high schools, as taken from the reports prepared by the United States Office of Education, since 1900, reveals the following deplorable situation. Columns I, III and IV are copied directly from tables, while columns II and V are calculated and interpolated by the writer. The total enrollment figures for 1951, however, are those recently released by the Office of Education.

I	II	III*	IV*	V**
Survey Year	*Total H.S. Enrollment*	*Percentage Earth Science*	*Number Earth Science*	*Comparison 1900-%*
1900	513,000	29.8	154,000	154,000
1910	738,000	21.0	155,000	221,400
1915	1,163,398	15.3	178,000	349,019
1922	2,154,222	4.5	97,140	646,266
1928	2,890,250	2.8	81,017	867,075
1934	4,620,000	1.7	78,555	1,386,000
1949	5,143,750	0.4	20,575	1,543,125
1951	6,800,000	?	?	2,040,000

* From biennial survey; "Offerings and Enrollments in High School Subjects." U. S. Office of Education.

** Column V. gives the number of students (29.8%), who would now normally be enrolled in Earth Science should the subject have continued to maintain the popularity it had in 1900.

We might comment at some length on the foregoing table, but for the most part these figures speak for themselves. Of one matter, however, we cannot refrain from speaking, that is, at this moment, in many high schools, the subjects of physics and chemistry are now on the brink of a like toboggan, and unless immediate and positive steps are taken to halt the trend, they too may likewise go the way of Earth Science in the next half century. Neither of these subjects is now an entrance requirement in many of our leading Universities, except for certain specialized courses, and it is a well known fact, in these days of automobiles, T.V., and radios, that the average high school student most certainly will gravitate into those courses which require the least mental effort, and of course these are not science subjects.

Returning to the matter at hand, it seems almost inconceivable, in a modern "shrinking world," such as ours, that insofar as our Secondary Schools are concerned, we are at present, turning out a generation of students, future citizens soon to take over the affairs of our country, who are so woefully ig-

norant concerning the physical Earth which is to be their natural habitat for their entire lives, that they can scarcely give a plausible explanation for the cause of day and night, the changing seasons and weather, or for any one of the "hundred and one" simple questions associated with Earth Science, which are so pertinent to their daily existence.

Such knowledge truly makes for a more wholesome, satisfactory and intelligent living experience, which in turn begets better citizenship. Certainly, we do not hold that "Earth Science" education will immediately resolve all our social and political problems, but we sincerely believe that more adequate and complete knowledge concerning our physical environment will make for clearer thinking, improved mental attitudes on the part of the individual and will also dispel much of the superstition which now so frequently besets mankind.

Here then, is the principal premise of our thinking. It appears that somewhere there must be a sizable gap in our educational offering in the secondary schools that needs mending. Some new challenge is needed to stimulate interest in science. Where in 1900, approximately one high school student in every three studied Earth Science, in 1950 there was only one in seventy-five, and perhaps in 1952, only one in one hundred. For those who say there are now no more new frontiers in education to explore, here is a matter that certainly merits serious consideration. Earth Science might well furnish those frontiers, and there are now forces at work plowing the fields in this direction. To whom can we look to sow the seeds? Surely Earth Science has hit the bottom of the trail and has no other way to go but to climb upward again. Will it take another fifty years for it to assume its rightful position as the most basic and fundamental science, or can the climb be made in a decade? All this will depend upon the effort and sincerity of all those who are most vitally interested, and that first is the Earth Scientists themselves. *There are New Frontiers in Science Education*, and Earth Science is one of them.

INCREASE EMPHASIS ON GEOPHYSICS

The Department of Geology at the Massachusetts Institute of Technology has been renamed the Department of Geology and Geophysics to recognize increased emphasis on instruction and research in geophysics within the Department.

The Department now offers two separate courses, one leading to the degree of bachelor of science in geology and the other to the degree of bachelor of science in geophysics. Either course satisfies the requirements for admission to the M.I.T. Graduate School for work toward advanced degrees in geology, geophysics and geochemistry.

Although the two courses of study are essentially similar for the first two undergraduate years, they differ greatly in the third and fourth years. In these years, majors in gology follow the traditional advanced work in this area, while majors in geophysics take additional courses in mathematics, physics, and electrical engineering.

Both courses require the summer following the sophomore year to be spent at the M.I.T.—Nova Scotia Centre for Geological Sciences at Antigonish, Nova Scotia, where students learn surveying, mapping, and geological field methods.

An optional cooperative program in geophysical field training has also been arranged for the summer following the junior year with the Geophysical Service, Inc., of Dallas, Texas. The student participating in this program joins a field party engaged in seismic work in an area of active petroleum exploration.

* * *

Gem stones have no definite, hard-and-fast market price, like a bushel of wheat or the tuition for your daughter's college. A gem is worth what the buyer will pay for it.—W

Famous Lost Mines

THE LOST CHINESE ROCKER

by Victor Shaw

In our list of lost mines, this placer seems unique. Not only do the reports claim it was found by Chinese miners in Alaska a little over fifty years ago, but all reports are oral. None to our knowledge has been published. In addition, most of its area as reported was quite thoroughly prospected at intervals, from the summer of 1925 up to 1936, by this writer.

If so, you might ask why wasn't it discovered? To this, the reply is that locally the area of some 70 square miles is extremely rugged. Its Mesozoic metamorphic sedimentaries and volcanics are folded and distorted. Moreover, the whole terrain is virgin forest, with dense stands of hemlock, spruce, cedar, brush, and devil's club with thick moss under all. Prospecting is a real job.

If you ask what brought Chinese to that region more than 50 years ago, the answer is that they were hired in San Francisco to work as common laborers in the few salmon canneries in southeastern Alaska, some years before the great Klondike Stampede in 1898. Also they learned placer mining during the California Days of '49.

Now, when prospecting this same region in 1898 (vide: An Alaska Gold Deposit—E.S.D. Nov. '46) we heard no rumor of Chinese placer mining in that region. In fact, there were no reports of any gold placers south of Juneau; and at that time it was generally conceded that local streams were too short and swift to form such concentrations anywhere along those coastal mountains.

So it was a quarter-century later, on our second prospecting venture in that district, that we first heard of a lost Chinese gold diggings. And we clearly recall how it came to our ears.

At that time our base camp was a log cabin near the head of Helm Bay, a six-mile indentation in the south shore of Cleveland Peninsula, a part of the mainland between Behm Canal on its eastern side and Ernest Sound to the westward. A strong belt of auriferous black slate and schistose greenstone lies along the west side of the bay, where we had done some prospecting in 1898. It was a promising region geologically, and not properly examined in the hilly areas to the northwestward and around Union Bay, which is around eight miles airline and true northwest from the head of Helm Bay.

When in camp one evening, a neighboring sourdough miner we knew dropped in for one of our frequent smoke talks; and we asked him if he knew anything about an old campsite we'd seen at the bay head.

"Shore do," he grinned. "Four fellas holed up thar some six years ago, that was a-huntin' the lost Chink rocker. You hear of 'er?"

"Never did," we denied. "Where is it supposed to be?"

"Why, they say she's some place around Union Bay. But them fellas raked 'er all with a fine-tooth comb an' never seen a rocker."

"Still 'lost', eh? How long ago was the placer found?"

"Mebbe 25-30 years. Them Chinks worked at the old cannery on the east side of Union Bay, and worked the diggin's in spare time. I had a pardner was foreman at that cannery, an' he tole me he seen some of that Chink gold — mostly coarse, pure quill, and about 18-fine."

"Ever try to find that rocker?" we inquired curiously.

"Heck no, I'm no gravel-sifter. I'm a hardrock stiff, too blame busy gettin' to my ore vein, to monkey with them fool idees."

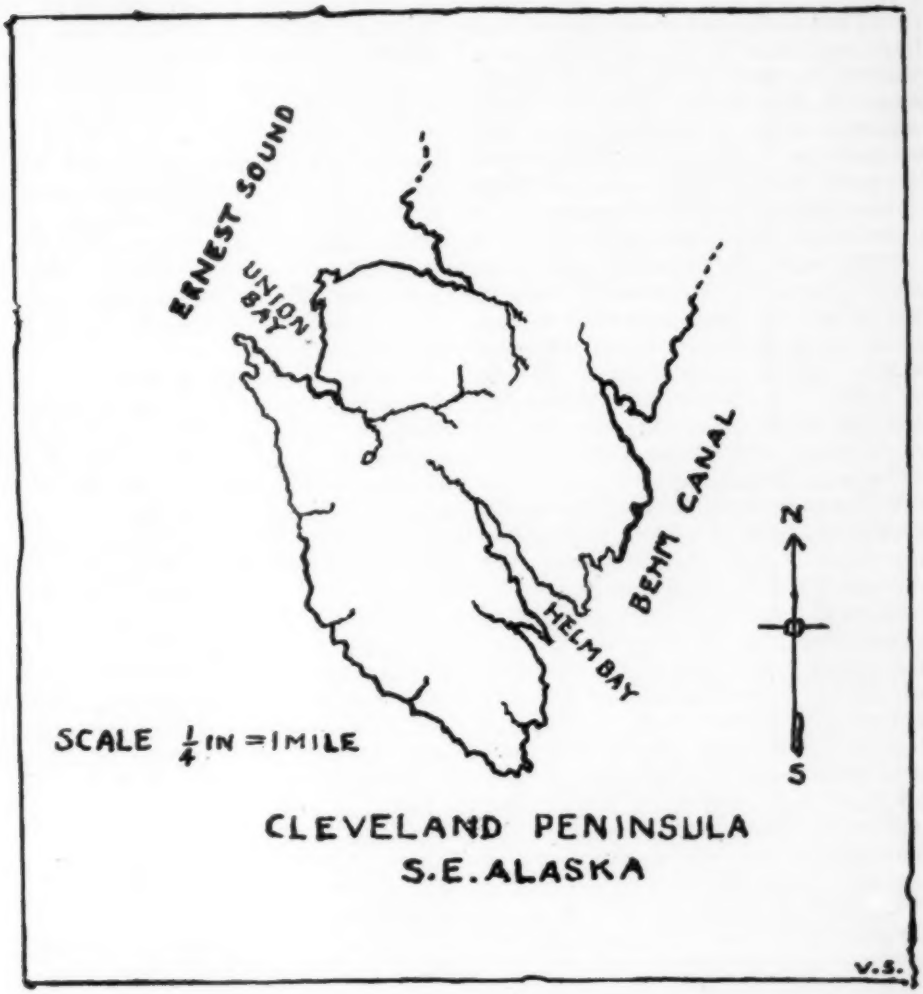
With which we heartily agreed, and for similar reasons.

Then, six years later in the spring

of 1932, a campmate of many years came up to hunt, fish, and do some prospecting. And so, as we had just secured a recent report of the U.S. Geological Survey with a map, we made camp in our old log cabin near the head of Helm Bay.

The report mapped a previously unknown boss, or stock, of the ultrabasic peridotite, that was situated about 3 air-miles southwest of Union Bay and some 4 air-miles northwest of our campsite. It was similar to a smaller stock halfway down the west side of our bay, where a dozen or so quartz-gold veins had been staked. So naturally we were eager to be first to examine this promising new intrusive.

Our first sortie into that jungle maze of hills proved a flat failure, but on a second attempt we topped out on the crest of a high ridge and there, about a half mile away across a deep canyon we saw vari-colored mountain with three sharp peaks. It was at the proper place and rock hues were unmistakable. It had to be the stock of periodotite we were seeking, without question.



Several hundred feet below our ridge comb was a high bench, its off-side sloping steeply to form a wall along the sky blue water of a large lake. From a

high hill basin to our left, a creek flowed down past our three-peaked mountain into the head of this lake. Its outlet creek ran through a narrow canyon on our right, to the lowland drainage area at the head of Union Bay. This with one sweeping glance.

Looking down the cliffy flank of our ridge some 400 feet, we noted a creek winding across the top of the bench, and beside it a queer dark mound that resembled a beaver house, but which under our binoculars seemed more like a huge mountain rat's nest. And at one side of it there were several square areas of open brown earth for which we could assign no logical reason. But, we suddenly noted several places where the creek banks formed straight lines, which must be man-made — obviously the work of placer miners.

With curiosity aroused, we made short work of a roundabout path of descent to the open grassy bench top, which in fact proved to be the temporary shelter of two placer miners. Its walls were made of huge chunks of turf cut from those dirt squares. It was roofed with turfed-over tin squares of flattened five-gallon cans and in one corner was a crude chimney of spruce poles to guide smoke from a smouldering cooking fire inside, where two bearded miners were at lunch.

We were loudly welcomed and offered coffee, fresh-made in a battered tin can that seemed the best in flavor we'd ever tasted. They'd backpacked in from Meyers Chuck, on Clarence Strait, stumbled upon this placer and had made $2.00 a day by panning. But they had just whipsawed out a rocker that would make them $10 a day with less labor. Beside this, they'd staked a gold vein on the ridge above the bench, from which the placer gold had come, and planned to mine that vein whenever the placer gravels played out.

Asked if the creek down the canyon to the lake showed any colors, they said it did but this creek was richest, and the outlet creek from the lake didn't pan at all. How then did they find this placer? Oh, they'd been hunting deer and just stumbled onto it.

(The foregoing picture, we assure you, we relate because it has a real bearing on our subject. Also, the following brief description of local geology may have some interest, because it offers a definite hint as to just why the Chinese Rocker became "lost.")

Locally this area comprises some 70 square miles bisected centrally by what we termed a "lowland drainage into Union Bay." It also extends southeast to form a like drainage into Helm Bay, from a central high point less than 100 feet above sea level.

Actually this is a major fault zone some 20 miles long, as we estimated on the ground (see sketch map herewith) and the rock formations of each differ widely in type, but igneous rocks of both sides are of the ultrabasic character. Southwest intrusives are Archaic granites and peridotite, whereas northeast, dioritic pegmatite and pyroxenite prevail, with also a strong belt of horblendite.

Southwest bordering Helm Bay and extending several miles northwesterly, there is a wide belt of schistose greenstone. This contacts inland a belt of black slate. Both are highly metamorphic with numerous auriferous veins with a quartz or calcite gangue. Inland and beyond are alternating zones of limestone and argillitic sediments, all of these much folded and intruded by scattered areas of granite, beside the two stocks of ultrabasic peridotite.

Northeast of the fault is an area of Paleozoic metamorphic sedimentaries and volcanics. Due east from Union Bay lies a large area of titaniferous pyroxenite and ilmenitic magnetite; but southeast, this pyroxenite is cut by many dikes of pegmatite in a hilly region, beyond which is an extensive zone of hornblendite.

The pyroxenite is the diallagite variety, a medium-grained but granular rock of typical dark-green color, with a gneissic structure probably resulting from flowage. Scattered areas of granite lie a few miles in from the fault to the east, which form the cores of a melange of hills of medium height; and

(*Concluded on Page* 35)

Uranium Is Where You Find It

RESEARCH CHEMIST — PROSPECTOR!

by Dr. Ben Hur Wilson
Staff Member

In our rapidly changing world, many of our long established concepts pass away. Time was, whenever one heard the name prospector mentioned, he immediately conjured up visions of some old be-whiskered man, perhaps living a hermit life in a lonely cave on the mountainside, traveling about from place to place with a pack-mule, eking out a precarious existence which only the most hardy individual might endure.

The picture now has changed, and we have a wholly different version of the modern prospector. He may perhaps be riding about the country on comfortable trains, thru the countryside in swift fleeting automobiles, supplied with ample money, living in the best hotels available in the region in which he is working. He may also have at his disposal as many assistants as may be needed for the job, making use of the latest and most modern instruments that the physical sciences may afford.

We must hasten to add, however, that we well realize that there are many exceptions to this fine picture, and that many a modern prospector must endure severe hardships in connection with geological reconnaissance, which make it figuratively "no bed of roses."

The modern prospector may be a college or university graduate, or even a Ph.D., working in some one of the great research laboratories operated by modern industry, aided by all sorts of technological facilities, often costing hundreds of thousands of dollars where only hundreds of dollars might have been spent fifty years ago, on a similar project. And for what are they seeking? All kinds of elements, both useful and destructive, many of which had no known uses and were therefore practically unheard of in the days of our grandparents a few generations ago.

From the earliest times, such valuable metals as gold and silver have been sought after far and wide. That Jason might prove himself worthy of the throne of Jolcus, which he claimed from the usurper Pelias, his uncle, he was, according to Greek mythology, commissioned to go out, search for and bring back the famous "Golden Fleece." We believe that Jason might properly be designated as man's first prospector, certainly the first mentioned and best known in ancient literature. Even in modern times this endless search still goes on, and how frequently we yet hear the old saying, "Gold is where you find it."

Today the scene has changed. While our enormous gold reserves are now safely (we hope) buried in impregnable vaults far beneath the surface of the ground at Fort Knox in Kentucky, our prospectors are out in frantic search of an even more elusive element, uranium, upon which the very existence of our nation may well depend. Day and night, year in and year out, our modern prospectors with Geiger counters are now ceaselessly searching for uranium, and other fissionable elements, over hill and dale, and mountain and plain, throughout the whole wide world, and believe it or not, it is sometimes found in the most unexpected places. Today the saying is changed, and we may now truthfully say, "Uranium is were you find it."

Recently, a new source of this precious metal has been uncovered, hiding away in one of the most surprising places imaginable, by research chemists working in the laboratories of a chemical plant far removed from all mountain ranges and other conven-

(*Continued on Page* 26)

Air-view of the Blockson Chemical Company's Plant at Joliet, Illinoi
Gulf Waterway in the background. Note o

at Joliet, Illinois. View of coal and ore docks located on the Lakes to ground. Note ore and sulphur piles on the lot.

tional sources of uranium. At the Blockson Chemical Company's works in Joliet, Illinois, specialists in the production of wet-process phosphoric acid, research workers—chemical prospectors if you please—have proven and provided ways by means of which the minute fraction of uranium which has long been known to be securely locked up within the phosphoric acid molecule lattice may now be successfully dislodged and recovered in usable quantities, at a cost which makes the process practical. Here, then, are unsung heroes of industry who, working quietly and secretly, have made a splendid contribution to our national defense efforts, the value of which may scarcely be realized.

It appears that in every ton of marine rock phosphate there exists somewhere between .2 and .5 pounds of uranium. For many years, states Sheldon P. Wimpfen, of the raw materials division of the Atomic Energy Commission, farmers, unknowingly, have been spreading fertilizers made from phosphate rocks containing small quantities of uranium, which neither help nor harm plants in any way. These phosphates for the most part, however, are employed as fertilizers in non-concentrated (dry) form from which at present it is not economically feasible to recover uranium by any known means.

To recover uranium in quantities, the fertilizer industry, therefore, will have to change their methods of production and specialize in the more concentrated products, utilizing the wet-process, producing superphosphates and nitrophosphates which in the long run, it appears, may prove to be more economically sound than the general practice now employed.

A full-scale plant, the first of its kind in the country to be employed for the recovery of uranium salts, from which pure metallic uranium is eventually extracted, has been built and is now in successful operation at the Joliet plant of the Blockson Chemical Company. Similar methods of extracting uranium as a by-product are now being tried out at other phosphate plants located in various parts of the country. Most of these, however, are yet in the pilot-plant stage.

Extracting uranium from marine rock phosphate will naturally increase rapidly with the production of the more concentrated forms of fertilizers. The Atomic Energy Commission, along with the fertilizer producers themselves, is now making a concerted effort to overcome many of the technical difficulties involved, so as to make it more economically feasible to recover the uranium fraction by production of superphosphates and nitrophosphates rather than marketing the dry product.

These efforts are now being encouraged by both material and technical aid from the AEC, and progress is being thus surely speeded up. Aid is being given in the form of applications for rapid write-offs and priorities on critical construction materials. For example, certain chemical plants have been given certificates of necessity for trebling their superphosphate output, and to include uranium recovery facilities. Aid, however, for the present is restricted to plants whose processes are suitable for one or another of the uranium recovery methods approved, and technological information is furnished only to those persons cleared under the Atomic Energy Act.

While it would, perhaps, be difficult to undertake a non-technical discussion of the sources of uranium in the numerous phosphatic minerals, it appears in general, that most of these ores are either directly or indirectly associated with marine origin. It is well known that water is a universal solvent and that there are in the aggregate large quantities of practically all of the elements, including uranium, in solution in the ocean waters. Many of the workable ore bodies show distinct evidence of organic life; the fossil remains of teeth, bones and phosphatic shells are abundantly evident as distinct proof of their marine origin. Florida "rock" is the ore being processed at the Joliet plant, but there are western phosphates which might also be used.

Phosphorus, it seems, has a singular affinity for uranium, such that in the chemical treatment of the ore, the uranium remains attached, although not combined, throughout the process, and therefore shows up in the molecular lattice of the phosphatic compounds. This tight grip is such that, until recently, it has defied all efforts to detach it by any practical or economical means. It was this very tricky problem that research chemists at the Blockson plant were able to solve. The description of the method employed is naturally highly confidential in the interest of national defense, so we cannot at present pursue the matter further. It is interesting to note, however, that in perfecting the process, a small pilot plant for the recovery of uranium salts was constructed and operated in the main plant by the regular workmen, who apparently had not the slightest inkling as to what was going on. It was upon the success of this initial pilot plant that the AEC decided that the whole scheme was feasible. More power to the *Research Chemist-Prospector.*

References:

(1) Science News Letter—Nov. 24, 1951, pp. 329. "Uranium Will Be 'Mined' from Fertilizer."

(2) Chemical Week—Dec. 1, 1951, pp. 21. "Bargain By-Product."

(3) Chemical & Engineering News—Nov. 26, 1951, pp. 505. "Plant for Recovering Uranium from Phosphate Under Way."

(4) Ibid—December 3, 1951. "Extraction of Uranium from Rock Phosphate Now Approaching Commercial Scale Production."

THE MINERAL HOBBYIST

A newcomer in the field of Rockhound journalism has recently made its appearance as a neat little magazine, carrying the masthead, "The Mineral Hobbyist." Edited by Mr. Hugh Leiper, 1700 Rabb Road, Austin, Texas, this publication has been made the official organ of the Rocky Mountain Federation of Mineralogical Societies. A recent issue which has come to our desk is very attractive and we extend congratulations to the editor and staff, wishing them success in their new venture.

The Rockhound hobby plays a definite part in the earth science picture. Without such forces at work and the enthusiasm they engender, the movement to re-establish earth science education in our schools would never have gained the momentum it has.

Answers: **Test Your Knowledge.** Check the ones which you have answered correctly.

a.—(1) A hollow ball of stone lined with crystals of quartz, calcite or other minerals.

b.—(1) A soft, steel-gray to black, more or less impure, native form of carbon. One of the allotropes of carbon.

c.—(1) Calcareous (usually) icicle-shaped formations hanging from the ceilings of caves.

d.—(1) A variety of quartz (chalcedony), originally only red, but of late including other colors.

e.—(1) Pertaining to clastic deposits laid down by running water; i.e.: as of alluvial soil.

f.—(1) Rock formation composed of angular fragments which have been cemented together by one or various cementing agents.

g.—(2) Describing slender, needle-shaped crystals; i.e.: millerite, rutile, etc.

h.—(2) A fibrous variety of gypsum, or of aragonite, having a silky lustre.

i.—(2) The property of a metal which enables it to be drawn into a wire.

j.—(3) Crystal forms possessing three axes, all equal and each standing at right angle to the other two—the cubic system.

k.—(3) Igneous rocks which have cooled quickly from magma extruded upon the earth's surface—usually non-crystalline.

l.—(3) A device used in early mining operations, creating an air-blast by water flowing through a series of baffles enclosed in a long trough-like box.

Total_____ Score: 1-6 poor; 7-13 good; 14-20 excellent; 21 perfect.

Studies in Coal

III—THE VARIETIES OF COAL

by Dr. Frank L. Fleener
Joliet, Illinois

1. *Peat.* One of the most important deposits resulting from the filling of lake basins, swamps, etc., is the accumulation of vegetable matter known at peat. The relation of peat to the origin of coal has made especially interesting the study of the conditions of its accumulation. Peat is the brown to black carbonaceous matter formed by the partial decay of the vegetable matter in the presence of water.

The process of accumulation of the vegetable matter involves two essential factors: first, the restricted access of air to impede the growth of decay-producing bacteria; and second, an abundance of water to permit profuse and continued plant growth. According to Davis, peat formation is not taking place in areas which have less than twenty inches of rainfall, and the most favorable conditions appear to be a moist atmosphere and a mean annual temperature of about 45 degrees F. No peat bogs are found between latitudes 45 N. and 45 S. The process is especially important in the small lakes and swampy areas of the North Temperate Zone, where the depth of water is not too great for the plants to get a foothold on the bottom.

In the peat swamps today, the rate and extent of decay are controlled largely by the oxygen supply, which in turn is chiefly affected by plant growth, temperature, exposure to the air, drainage, etc. and in part, by the energetic cooperation of anerobic bacteria, yeasts, moulds, and fungi. As the process of decomposition proceeds, the products become waterlogged and sink to the bottom. Obviously, the growth of the accumulation requires that the rate of contribution of plant material exceed the rate of decay, putrefaction being finally halted by the exclusion of oxygen from the buried material or by the toxic influence of the waste products produced by the bacteria themselves.

When such conditions exist, the water saturating the peat becomes strongly antiseptic, which prevents further decay. (White & Thiessen.) This antiseptic quality is strikingly shown in the preservation of the bodies of men and animals entombed in the peat bogs thousands of years ago. Lyell in his Principles of Geology gives a number of illustrations of this effect, the following being typical: "In June, 1747, the body of a woman was found six feet deep, in a peat moor in the Isle of Axholm, in Lincolnshire. The antique sandals on her feet afforded evidence of her having been buried there for many ages; yet her nails, hair and skin, are described as hardly having shown any marks of decay."

The recorded observations as to the rate of peat accumulation differ widely, as is to be expected, since no two sets of conditions are duplicated exactly in different places. However, it appears fairly clear that under favorable conditions a foot of peat may be deposited on the surface of a bog in ten years. But, on account of continued bacterial action in furthering the decomposition of the underlying peat, and on account of the compacting of the peat under the superimposed younger layers, the thickness of a ten-year growth of surface peat is gradually reduced, according to depth in the bog, the conclusion being that at a depth of fifteen to twenty feet, a foot of surface peat will possibly be reduced to about one and an eighth inches. According to Soper and Osbon. "No definite evidence has yet been obtained to show the rate of their (peat beds) formation. Even under the most favorable conditions it (the rate) is too slow to be measured by ordinary observation."

The quantity of available peat scat-

tered over the Northern Hemisphere is prodigious, passing all comprehension. There are no comprehensive computations of the total amount available that are more trustworthy than mere conjectures, and in only a few limited areas having anything like accurate surveys been made. The results are enlightening. For instance, Science News reports: "It has been estimated that there is enough peat fuel of good quality in Minnesota alone to last until the year 15,255, if burned steadily a ton a minute." It thus is comforting to know that, when supplies of more convenient fuel are exhausted, our descendants will find in these bog deposits a hidden supply of fuel that will fill all their needs for millennia without end.

2. *Lignite.* Under the name of lignite or Brown Coal a number of substances are included, which lie between peat on the one hand and bituminous coal on the other. Geologically they are modern coals, Tertiary and Mesozoic, and their composition bears close relation to their age. The most recent approach peat, and the older are near true coal. However, this is not always true, for in some cases, due to peculiar conditions, lignites have been changed into bituminous coal locally; or, where the metamorphic action has been extreme, into anthracite varieties. When mined lignite contains from 30 to 40% water, upon exposure to the air this moisture is lost and they crumble; on this account, and because they produce low heat, they are little used as fuel except in localities where no other fuel is available.

Most lignite is of a chocolate-brown color, but varies to a dull black in some of the better varieties. It occurs compact and firm to earthy and fragile. Lignite often shows distinctly the texture and grain of wood or the intermatting of vegetable fibers. It burns readily, with a smoky yellow flame, giving off a strong odor of sulphur. The corbon content of lignite varies from 55 to 75%, unfortunately not much of it is in the latter class.

Geologically the lignites belong to the Cretaceous and Tertiary formations and often form conspicuous beds, where these formations occur. It is especially well-developed in the Cretaceous of the Rocky Mountain states, the most notable deposits being centered in the Dakotas. North Dakota is said to contain 600 billion tons of this potential fuel. At the State University in Fargo, North Dakota, the United States Bureau of Mines has established a laboratory for exploring the possible commercial significance of this material. The results are quite startling, when considered in the light of future supplies of gasoline, gas, creosote, coke, and several other minor but important products. In the early days of the settlement of the treeless plains of the Dakotas, these lignite beds were the salvation of the hardy pioneers. Other deposits of this low-grade fuel occur in the Pacific Coast region and through the Gulf States of the South.

3. *Jet.* Jet is a variety of lignite coal of quite limited distribution. It is of a uniform black color, and has a fatty lustre. Its hardness lies between 3 and 4—not too brittle to work easily. It takes a fine lasting polish, and was once extremely popular for mourning jewelry, crucifixes, rosaries, etc. It was once known as "Black Amber" because it was collected along the Yorkshire coast of England, where it had been thrown up by the waves. The chief production of jet is centered at Whitby, England, where it has flourished since about 700 A.D.

The Whitby jet occurs in irregular masses, mostly of lenticular shape, which are embedded in hard shales locally known as "jet-rock." The shales belong to the Triassic age and are very fossiliferous. Dr. A. C. Stewart, the noted English paleobotanist, believes that the jet originated from the alteration of a species of coniferous wood of the Araucarian type (the same as is to be seen in the petrified logs at Holbrook, Arizona). The sections cut from specimens that consist partly of petrified wood and partly of jet, show a gradual passage from the Araucarian wood to pure jet. The manner of the

segregation of the logs probably represents the accumulation of drift wood in rafts, which were brought to the seashore, where they became waterlogged and sank to the bottom; later they were buried in the mud, which eventually was turned into shale.

As all ornamental material, jet has a history that antedates all the precious stones. Worked jet has been found among the paleolithic remains in prehistoric cave dwellings in Switzerland and Belgium. Jet was very popular among the Romans; Pliny the Elder makes mention of it in one of his books. Also, the Venerable Bede gives a short description of it in his Historia Ecclesiastica Anglorum. The real work in jet at Whitby did not begin until about the opening of the nineteenth century, when it was found that jet could be turned on a lathe as well as being carved and engraved. By the middle of the century the trade was well established, and as many as 1400 artisans were employed in the production of articles from jet. However, at present, the jet trade of Whitby has fallen off to such an extent that it is feared that it will soon be a thing of the past.

Formerly sufficient jet could be gathered from the seashore to supply the carvers, but the great demand by pilgrims for religious objects carved by the friars of Whitby Abbey caused this source to fail. To augment the supply, mines were opened into shale beds in the cliffs near Whitby and in several places inland in Yorkshire, but even the supply thus obtained had to be supplemented by shipments from abroad. Much jet is still imported from Spain, but it is inferior to the Whitby material. France and Germany also produce some jet, but little is exported. In the United States jet is known to occur in a number of localities, but there is so little call for the material that it has never been systematically worked. Some Pennsylvania anthracite has been found sufficiently tough and free from grit to be cut into gleaming novelties of polished coal, which are eagerly sought for by collectors. This is not true jet, but merely a very compact variety of anthracite coal.

(To be Continued in May Issue)

Noted Personality Writes of Early History of Copper Mining in Lake Superior Region

(Copy of William B. Frue's correspondence when Superintendent of Silver Islet Mining Co. from 1870-1875. Now property of W. C. Frue of Hendersonville, N. C., grandson. Loaned to J. P. Bertrand, Past-president of T. B. Historical Society. Silver Islet was for many years the home of Jules Cross, discoverer of Steep Rock Iron Mines. His father worked in Silver Islet Mine.)

Earl Dunraven
c/o Mels Duncan Sherman & Co.,
New York
Dear Sir:

I have the honor to acknowledge receipt of your Lordship's letter of October 20th and was pleased to hear of your safe arrival at Chicago. I hope that by this time you are enjoying a good buffalo hunt in company with General Sheridan, and that your first shot will cause a stout old bull to bite the dust.

I have seen Dr. Tompkins about Indian relics and he promises to retain and add to his collection on your behalf.

Mr. McDermitt is also on the lookout for specimens and I have no doubt that an handsome assortment will be ready for your Lordship next summer.

I have the honor of enclosing herewith a brief sketch of our operations at Silver Islet from the commencement, also of our present condition and future prospects with a condensed report of the rise and fall of the various copper mines on the south shore of Lake Superior.

By the way, we had a narrow escape

in recrossing the Lake from Houghton. While rounding the west end of Isle Royale at 7:00 P.M. on Saturday, October 19th (an intensely dark night) the Captain of the "Silver Spray," judging that he had run a sufficient distance, hauled up on his course for Silver Islet. There was a heavy sea running at the time. I was keeping a sharp lookout (not feeling quite safe) and perceived after a time low rocks ahead. Immediately informing the Captain, the engine was reversed and the wheel put hard astarboard but we merely escaped Scylla to fall into Charybis. "Evitata Charybdi in Scyllam incidere."

We found that we had struck on a sunken reef. The heavy sea enabled us to back off, but we were hardly afloat before we found that we were aground at the stern, losing the stern-post and shoe and bending the rudder to the shape of a beaver's tail. We remained in this perilous position for at least an hour and a half and after considerable exertion, succeeded in disengaging ourselves, arriving safely at Silver Islet about 1:00 a.m. on Sunday, October 20th.

The accident was caused by the action of local attraction on the compass deceiving the Captain. "Ex hoc malo proveniat aliquod bonum."

This same local attraction may be the means of making a fortune for me yet, as I am now engaged in the construction of a compass that cannot be altered from its north and south position by a whole mountain of magnetic iron ore, should it come into contact with such influence.

Hoping that the accompanying documents may serve the purpose,

(*Signed*) W. B. FRUE

November 3, 1872

To Earl Dunraven,

Report on the Rise and Fall of the Various Copper Interests of the South Shore of Lake Superior

Little was known of the mineral wealth entombed on the south shore of Lake Superior before 1839 and '40 except an occasional rumor of the finding by Jesuit priests, of large masses of native copper, the then native Indians having no knowledge of such deposits. About the above stated time several adventurers and explorers spent considerable time and money in a rough inspection of the country, but nothing in the way of actual mining operations was entered into until 1842 when a Company was formed bearing the title of "The Phoenix Copper Company." The word "silver" was subsequently added to this title by the following accidental circumstance, viz: mining was commenced under the supervision of Samuel W. Hill and in running a drift close to Eagle River (which gives its name to the town) a dried-up subterranean river bed was discovered almost immediately under the present bed. The cave was wide, high and of considerable extent, but had evidently been at one time the river channel and in it was found a mass of native silver weighing 40 pounds, together with several small pieces. This information being conveyed to the company, it was at once supposed that they had hit on the immediate vicinity of an immense Eldorado.

The stock, then worth two or three dollars per share, suddenly advanced to several hundred dollars, but, as the further operations failed to point out the spot from which the silver came, the stock gradually receded and mining was confined to copper bearing fissure veins and a belt known as the ash-bed. All, however, worked without any profitable results. Although mining was not abandoned at any time, little was accomplished by this Company till 1863, when a man hunting cows came across an ancient working south of the Greenstone on their property. It was marked merely by a slight depression, the original pit being filled up by decayed vegetable matter. In clearing this working it was found that the ancients had sunk through 17 feet of the natural drift and the bottom of the excavation was proved, as it were, to be solid mass copper. The vein since then has produced well. One mass taken out and cut up was estimated at 600

tons of pure metal. The Company is still operating successfully.

About 1843 great excitement was caused by the discovery of a large mass of copper weighing several tons in the Ontonagon River which brought into the country another corps of bushmen and explorers, resulting in the further discovery of ancient mining south of the Greenstone at a spot now known as the Pittsburgh & Cliff Mining Property.

The Company was at once formed and work started continuing successfully and paying enormous dividends until 1866 when the working of the mine became too expensive to be remunerative. This might be in a great measure attributed to the incompetency of the early managers in planning their works.

The Greenstone is an immense belt of highly crystalline homogeneous trap, dips at an angle of 35 degrees from the horizon to the northwest, its outcrop rising perpendicularly 500 feet.

The vein cuts this belt at right angles but in it is not productive, though rich immediately under and for 600 feet to the south of it. The rich portion of the vein or chimney as it were, followed the trap, dipping under at the same angle of 35 degrees.

In sinking perpendicular shafts of course the greater the depth attained the greater would be the distance to drift before striking the rapidly receding rich portion and the mistake made in the first place was in not sinking the shafts at the same angle as the ore dipped. Notwithstanding such drawbacks, the mine paid back millions over and above the sums invested and I suppose the stockholders were well satisfied. Had the mine been only laid out right at the commencement it would have paid double and remained to this day a paying concern.

The remarkable and unparalleled success attained here at the beginning was the means of inducing further interest in the country resulting very soon in the establishment of the Minnesota, Copper Falls and National Mines, all with more or less success, the first named especially, paying enormous dividends to its shareholders for 10 years. The Copper Falls is still a producing mine, but with the wheat, tares were sown and the success attendant on these concerns caused the springing up of several, such as the Toltic Mining Co., Norwich, Douglas Houghton, Evergreen, Hilton, Aztec, Bohemian, Flint Steel, Fire Steel and fifty other defunct companies on the Ontonagon District and the Eagle River Mining Company, St. Clair, Meadow, Dana, Patrick, Eureka (which was a big whopper) in the Keewenaw District. There were probably 20 others in the same district. The failure of these many worthless speculations dampened the spirits of investors, and it was not until 1849 and 1850 that another brood was palmed off on the public in the form of the Wheel Kate, Dacotah, Montagume, Torch, Lake and so forth, which as far as worth was concerned, all proved worthless.

And yet, I believe that as good can come out of evil, also the present prosperity of the country is owing indirectly to these failures, for it was while these were prospecting that a series of ancient diggings was chanced upon in what is now the property of the Isle Royale and Grand Portage Companies. This discovery, though promising well at the outset, turned out but sparingly.

They in like turn are entitled to credit for the present success. Had it not been for these, the district would have been lost sight of as it was the openly expressed opinion of all scientific men that it was utterly worthless so far regarded mining wealth. Also these would-be-wise at the time said that copper would not be found in the conglomerate, at least in paying quantities. Shortly after such statements found their way into the newspaper over the signatures of the recognized authorities in geology, the Minnesota Company found a mass of 500 tons of copper in the so-called unproductive

conglomerate. This gave the theoretical opinion a "black-eye."

Owing to the above mentioned promising oppearance at the Isle Royale and Grand Portage a number of other companies was floated in 1852, viz: The Huron, Dodge, Webster, Sheldon, Albany, Ripley, Pewabic and Star, with others. Mining was now lively all around until the winter of 1852, when on the arrival of the first mail on February 10th, 1855, bringing instructions to close down nearly all the works, several hundred men were compelled to start in mid-winter through a dense forest on a trip 300 miles with packs of crackers and pork on their backs for provisions during the journey.

At this period six men, not desirous of leaving the locality, entered into a contract with the Pewabic Company to have all the copper they could raise in three months, and for no perceptible reason, shovelled the snow off a space 20 feet square and went to dig the next day. Before night their efforts were crowned by their striking the lode now known as the Great Pewabic, successfully worked since that time by the Franklin, Pewabic and Quincy Companies, all paying well to their respective owners.

On the success of these were started the Pontiac, Menard, Dorchester, St. Mary, Dudley, Dover, Acadia, Concord and the Albany & Boston. Despite the promise of value given by some of the latter they all went under.

In 1855 a very extensive old digging was found south of the Greenstone in Keewenaw, and on this was organized at once the Central Mining Company. In the clearance of the working it was found that the original properietors had gone through 12 feet of solid earth in order to uncover the vein — also that they had excavated around two masses of over fifty tons each.

Since the commencement the operations have been satisfactory and remunerative to the share holders. The last "big thing" struck on the mineral range was at the Calumet, located in Houghton County. It was happened upon by a Mr. Scott, who in making his way through the woods, stumbled into what proved to be an ancient working. Work was commenced here in 1866. Continuously since then it has gone on producing and it is now turning out more copper than any other mine of its size. The original stock cost $15 per share. It has paid on the stock $80 during the past year, or the enormous dividend of $3,200.00 There are rumors of an even greater discovery shortly to come to light.

Like most great concerns, it had the drawback of bringing into the market many such as the Ossippee, Schoolcraft, Iroquois, Kearsarge, South Pewabic and Frue Mining Companies, of which none but the Schoolcraft are now at work. It bids fair to be a profitable enterprise and I have no doubt that some of the other mines that have been abandoned may prove, with some prospecting, valuable concerns.

The metalliferous deposits of this region may be classed under three heads, viz: fissure veins, veins of contact and amygdaloid veins or belts. The latter run parallel with the formation which is about 3½ miles in width and is composed of a series of belts of red, gray and black trap, separated at intervals by conglomerate belts and green and brown amygdaloids, brecciated conglomerate and what is known as the greenstone. The formation is tilted up, dipping at angle of about 46 degrees from the horizon, and is underlaid by sandstone. The underlying stratum is the same as the Potsdam sandstone.

I have heard many theories advanced in regard to the natural position of things when the formation was thrown up — none of which, however, appears clear or feasible to my mind.

Nor can I, with any of my conjectures, arrive at a satisfactory conclusion. One thing, however, is evident, viz: that at the time when the eruptions composing the formation took place, the rocks which are now tilted up must have been in a horizontal position.

Otherwise it would be difficult to account for the conglomerate belts which

are composed of rock foreign to the formation itself and consist chiefly of porphyry, jasper, and feldspar. The nearest source from which these rocks could have come was 140 miles distant, their original position being on the north shore of Lake Superior. Nearly all the belts of conglomerate (which are quite numerous) occurring in the trap formation, are composed of round pebbles, giving evidence of much wear and cemented together with a fine gray sand, feldspar and copper, proving that they must have travelled from a distance. This shows that the building of the formation was quite slow-eruptions occuring only at long intervals. My belief in the horizontal position of the formation is strengthened by the identity of the rocks on Isle Royale with those on the south shore. At the former place the greenstone is visible and is exactly the same as that found at the latter place, where it forms as it were, the back-bone of Keewenaw Pt.

The dip of the rocks at Keewenaw Point is the northwest and at the angle given above, with this exception, that as you approach the Lake they are less tilted up, forming an angle of not more than 25 degrees from the horizon, while at Isle Royale the dip is to the southeast and at about the same angle as on the south shore.

This leads me to believe that the great crater which furnished the material for the construction of the formation, must have been located somewhere midway between Isle Royale and the south shore, and that after having exhausted itself, an earthquake might have occured causing the formation to settle in the centre and leaving its two edges tilted up. This no doubt formed the basin which is now Lake Superior. My theory may be simply illustrated by placing a heavy weight in the centre, and on the top of a series of layers of pasteboard, the centre will be depressed and the edges will approach each other, the dip diminishing on the top layers as you press the centre of the depression.

You must be forcibly struck by the frequent allusions to the valuable discoveries brought to light by explorers tumbling on the remains of ancient diggings. Many theories have been advanced in regard to the ancient miners — who they were, where they came from, where they went to and at what point of the world's history the work was performed, but no satisfactory conclusion has yet been reached. Some have argued that the face of the rock was completely bare at the time of ancient mining, thus enabling the ancients to discover the many lodes worked upon.

This idea, however, is pretty well exploded, since the discovery of the ancient work done at the Central, Franklin, Pewabic, Quincy and Phoenix, as it is evident at all of these points that the ancients had to excavate from 10 to 17 feet of depth through the common drift of the country before the backs of the veins or lodes were uncovered.

Some of these openings extend at intervals along the back of a vein for upwards of a mile in length, and notwithstanding the serpentine course of the vein, every opening proves the skill of the ancient miner and shows that no labour was thrown away in cross-cutting to open the vein. All of their works establish this fact, *viz.*: that no labor was done on the back of the lodes except where rich deposits existed. How they succeeded in selecting those spots or dialling them out, remains an unsolved problem. Their principal tools used in mining seem to have been long, hard, oblong pebbles or boulders.

Still there is evidence remaining that they used edged tools, for I have myself cleared out several of their pits, in one of which a log had been cut off with a sharp implement. The surface cut was about 6 superficial inches. I have also taken out from the bottom of another pit which was sunk 16 feet in the rock, the end or butt of a log on which the unmistakeable evidence of an axe (apparently of similar form and structure to those in use at the present day) was visible, as though the cutting had been

done the preceding day. This log is still in evidence and can be seen in Boston, Massachusetts. This pit was completely filled in with decomposed vegetable matter and there was scarcely a visible trace of a depression, while immediately on top and nearly in the centre of the pit there was a tree growing upwards of three feet in diameter.

That mining has been carried on by the ancients at different periods is indisputably proved by the large openings at the Calumet. In making an examination of the burrow deposited around this pit on the natural surface, it showed four distinct layers of vegetable matter mingled with the debris.

This can be accounted for only by the assumption that work had been performed at long intervals. At some points their works were quite extensive — at the National for instance where they sank for over 45 feet in the rock. In clearing out this opening a detached mass of copper, weighing about six tons was found, elevated some 10 feet from the bottom and resting in partially decayed timbers.

That the country was a dense forest at the time of those mining operations is evident from the fact that in clearing out the pits — sometimes at the very bottom — you will come across layers of leaves in a good state of preservation.

William B. Frue

EDITOR'S NOTE—

The report on the Silver Islet venture mentioned in the last paragraph on page 30 is not available to the editor. However, Dr. F. L. Fleener has prepared a most interesting report on it, which will appear in the March issue. Talk about bonanzas, be sure not to miss it! Order the Earth Science Digest now.

* * *

A breezy, ready-with-the-quip-and-barb, lady-secretary of an Eastern Society, was asked what caused fluorescence. To save a lot of time about orbit-jumping, etc., she simply said: "Fluorescence is caused by turning on a special lamp which emits U.V. rays." Oddly the questioner was satisfied!

FAMOUS LOST MINES (*from p. 22*)

southeast this diorite merges into an extended zone of hornblendic rocks, that weather rust-brown due to their ferrous ingredient.

The magnetite associated with the pyroxenite area east of Union Bay is of good quality estimated up to 30%. In fact, in the Coast Pilot notes on this bay, an easterly needle declination exists of 27° beyond normal; which argues that the magnetite deposits must be extensive. Although the Coast Pilot has carried these data during four or five decades, we've had no report of any investigation here for either magnetite or titanium, incidentally.

However, we have had reports from several local miners of "colors" panned from creek gravels of upper Black Bear Creek, which has its source in the pegmatite area mentioned above, and flows into the head of Union Bay. This being true, it seems obvious that those Chinese miners from the old cannery would have panned out some gold colors in lower Black Bear Creek. Then, as there is but *one* branch creek coming in from the westward — the outlet mentioned that panned no colors at all—they would have traced the colors up-stream to the eastward into the hilly pegmatite area just mentioned above. Yet to date the futile hunts for the Lost Rocker seem to have been confined to the region lying southwest of the central fault, instead of this more promising area on the easterly side. This may explain its loss.

And, so far as we know, the Chinese Rocker remains lost, in a promising region not yet properly explored. As a matter of fact, we and our partner have some exciting unfinished business up there.

COVER PHOTO—THE GRAND TETON

by Henry P. Zuidema, Staff Member

View is from within the Teton Range, *i.e.*, from the west toward Jackson Hole. Most readers are familiar with the conventional views taken from Jackson Hole. The Tetons rise abruptly along the great Teton Fault which flanks the range on the east.

Midwest Federation Bulletin

Edited by Bernice Wienrank, Staff Member

St. Louis Mineral and Gem Society, announcing that arrangements have been made to hold the Midwest Federation's 1953 convention in the gymnasium of St. Louis University, June 26-28, suggests that everyone "Meet Me in St. Louis."

The November meeting of SLM&GS featured two speakers: Mr. I. Reavis displayed both genuine and synthetic stones and told how to identify them; Mr. C. Wisely showed and discussed his collection of jade carvings and necklaces from Mexico. New officers were elected at the meeting and installed on December 13 at a banquet and Christmas party. Mr. Elmer Headlee, who is vice president of the Midwest Federation, was re-elected president of the SLM&GS.

Chicago Rocks and Mineral Society will celebrate its seventh birthday on February 14 with a gala birthday party. Guest speaker will be Mrs. Gertrude Lewis of Topeka, Kans. Mrs. Lewis, who is director of public relations for the Atchison, Topeka and Santa Fe Railroad, will speak on "Indian Jewelry of the Southwest." She will also present a beautiful display of Indian jewelry. Refreshments will be served after the program.

The birthday party, starting at 7:45 p.m., will be held in the Green Briar Park Field House, 2650 Peterson Ave., Chicago. Members of other societies are invited to attend.

Central Iowa Mineral Society, at its Nov. 7 meeting, awarded prizes totaling ten dollars for the three best geodes found during the group's two day field trip to Keokuk, Iowa, on Oct. 18-19.

The variety of geodes found was astonishing. The majority contained clear sparkling quartz crystals, but also found in the big rough-surfaced nodules were pearly white and frosty pink calcite crystals, tiny black hairs of magnetite, golden threads of millerite, cubes of pyrite, coatings of dusty hematite, pockets of powdery white kaolin and tiny clusters of botryoidal chalcedony. Some dolomite and ankerite were also found. Under the black light many of the geodes fluoresced green, pink and dark orange.

Earth Science Club of Northern Illinois conducts one of the finest educational programs in the Midwest Federation. It presents weekly classes, taught by professionals, on the following subjects:

Determinative Mineralogy
(Dr. Frank Fleener)
Archaeology (Elaine Bluhm)
Silver Work (Walter Briggs)

ESCONI also has long been a leader in the movement to introduce the study of the earth sciences into secondary schools and junior colleges.

Akron Mineral Society is scheduled on Jan. 17 to hear Dr. Acquarone of Akron University discuss "Metamorphic Rocks." After his talk, a large collection of fossil and mineral specimens will be auctioned off.

On Dec. 20, AMS enjoyed a Christmas banquet complete with music. Guest speaker for the evening was Walter Brown, Ohio State Geologist.

Wisconsin Geological Society's current project is one that could well be emulated by other Midwest Federation Societies. Called "Bundles for Britain," it aims at obtaining representative minerals and fossils from WGS members for donation to the world-famed British Museum of Natural History. W. N. Edwards, the London museum's keeper of geology, states that his department has comparatively few fossils from Wisconsin and would be glad to receive almost any kind from the Ordovician, Devonian or Silurian periods. WGS asks, "How about the Illinois societies sending some superb Mazon Creek fern fossils?"

Minnesota Mineral Club at its first indoor meeting of the year, on Nov. 15, viewed stereoscopic color slides depicting highlight shots of national parks. These scenes were photographed by means of polarized light on Kodachrome film and when projected on a special screen and viewed with polaroid glasses present a three-dimensional effect which is amazingly realistic and truly beautiful.

Chicago Lapidary Club has set May 16-17 as the date for its forthcoming third annual competitive Gem and Jewelry Show. Competition is open to all amateur lapidary and jewelry craftsmen residing in Chicago or within a 50 mile radius of the city. Additional information, copies of regulations and entry blanks may be obtained by writing Lyman E. Carpenter, 7042 Dante Ave., Chicago, Ill.

Nebraska Mineral and Gem Club realized a dream of many years when it officially opened its own lapidary shop Nov. 16. Space for the shop was provided by members Mr. and Mrs. Dewey Anderson, who turned over their basement recreation room for that purpose.

On Jan. 17 NM&CG will hear Sharpe Osmundson and Carl Hutchens give a joint account of their trip through Mexico last spring. They will illustrate their talk with colored pictures.

Fort Randall Gemites last winter presented at the State University of South Dakota an "assembly line" demonstration of how to cut a cabochon. A rough rock was displayed and discussed by the member at the first position on the line. Each successive step in making a cabochon was then carried out and explained by another following person. The last man on the line placed the newly-made gem in a setting. This demonstration proved so successful that it has since, by popular request, been put on at two Pickstown clubs.

Cincinnati Mineral Society is currently working with the Ohio State Survey Commission by reporting all new mineral and geology finds to them. Similar opportunities await other groups wishing to add to the long list of contributions to science made by amateurs.

Central Nebraska Rocks and Minerals Society recently held its first exhibit at the Nebraska State Fair. There were excellent displays of cabochons and jewelry, and Mrs. R. A. Goettsche demonstrated cutting and polishing stones. The society's booth was the most popular one at the fair and local papers devoted much space to stories and pictures of it.

At present, the group is anxiously awaiting the arrival from Pribilof Islands of a trunk belonging to Director Eigistie of the Hastings Museum. The trunk contains colorful stones that Mr. Eigistie picked up from the beach while hunting seals, foxes and birds for the museum. It is hoped that the stones are gem material.

Illowa Gem and Mineral Society's annual banquet was held Oct. 25. A highlight of the evening was an exhibit of geodes which were collected over a forty year period by the Geode Industries of New London, Iowa. Colored slides of gems and minerals were also shown.

Rochester Earth Science Society member Maynard Fleener exhibited and commented on his beautiful collection of micromounts at the club's November meeting.

An exhibit of the various aspects of the earth sciences is maintained by RESS at Rochester College. An indication of the interest that it has aroused is the fact that at least five of Rochester's teachers are now attending an evening course in historical geology.

Marquette Geologists Association heard Mr. J. E. Farr, president of the Earth Science Club of Northern Illinois, talk on "Gem Stones of the Bible" at the October meeting. Mr. Farr introduced his subject by outlining the history of the Israelites to the time of Moses and of Aaron, his high priest. He then discussed in detail the twelve stones in the Breastplate of Judgment, made for Aaron and described in Exodus 39:

(*Continued on Page* 38)

"MEET ME IN ST. LOUIS" at the THIRTEENTH ANNUAL CONVENTION of the MIDWEST FEDERATION OF MINERALOGICAL AND GEOLOGICAL SOCIETIES

The thirteenth annual convention of the Midwest Federation of Mineralogical and Geological Societies will be held at the St. Louis University High School, 4970 Oakland Avenue, St. Louis, Missouri on June 26-27-28, according to Elmer Headlee, 221 East Argonne Drive, Kirkwood, Missouri, vice president of the Federation and president of the St. Louis Mineral and Gem Society, host organization for the conclave.

Convention Chairman K. E. "Ken" Gibbons, 6421 Hobart Avenue, St. Louis 14, Missouri, reports that arrangements already have been completed for many unusual and interesting exhibits, some of which have never been shown before; a convention banquet which will feature an outstanding speaker; field trips during the three-day session, with possibly a two-day post convention field trip thrown in for good measure. An added attraction will be an address by the well-known geologist and geological engineer, Dr. Albert J. Frank of St. Louis University, who will speak on the "Geology of St. Louis and Vicinity." Other attractions will include visits to the Municipal Opera, the world-famous Zoo, both of which are in Forest Park, adjacent to the convention grounds, and a boat trip on the Mississippi River on the air-conditioned Admiral.

Committee appointments announced by Chairman Gibbons include the following:

HOUSING AND TICKET RESERVATIONS—
Mrs. Jean Strope, 3529 Lafayette Avenue, St. Louis, Missouri
Miss Teddy Kratz, 2742 Meramec Street, St. Louis, Missouri

REGISTRATION—Mrs. Theodore Boente, 4980 Neosho Street, St. Louis 9, Missouri

FIELD TRIPS—Frank N. Signaigo, 8661 Trumbull Street, St. Louis 20, Missouri

EXHIBITS—
Commercial—W. H. Vesper, Jr., 109 Gray Avenue, Webster Groves 19, Missouri
Non-commercial: Lyndall Grosch, 6958 Mardel Avenue, St. Louis, Missouri

Persons interested in any particular phase of the convention should write to the chairman concerned as listed above. Otherwise all inquiries concerning the forthcoming convention should be addressed to Ken Gibbons, convention chairman.

* * * * * *

MIDWEST FEDERATION—*Continued*

10-13. Rough and polished specimens of each gem were exhibited in a lighted, portable case.

Michigan Mineralogical Society marks its 18th anniversary this month. Since its inauguration the society and its members have donated several thousands of dollars worth of mineral specimens to the Cranbrook Institute of Science, Bloomsfield Hills, Mich., where the group meets on the second Monday of each month. MMS now has a membership of 275.

Flint Hills Geology Club found a large variety of fossils, including brachiopods and tribolites, during its fall field trip to Ross quarry, near Ottawa, Kans. Pockets of calcite crystals were also found in the quarry's limestone.

The club holds a regular meeting on the third Monday of each month in the Science Building of the State Teachers College, Emporia, Kans.

The Midwest Federation deeply appreciates the fine publicity given the *Earth Science Digest*, its official publication, in the bulletins of the following societies: Nebraska Gem and Mineral Club (bulletin: The Rear Trunk), Wisconsin Geological Society (bulletin: The Tribolite), Oklahoma Mineral and Gem Society (bulletin: Sooner Rockologist) and Ye Old Timers' Mineral Club (bulletin: Ye Old Timers Bulletin).

— *NEWS OF OTHER SOCIETIES* —

Compton Gem and Mineral Club (Compton, Calif.) met great success with its annual show, held Oct. 4-5. Outstanding jewelry, including the world's largest black sapphire, was modeled by pretty club members. Other attractions were an hourly film on faceting and a booth where registered gemologists identified stones without charge. Free door prizes were given every two hours.

Oklahoma Mineral and Gem Society's recent field trip to Ouachita Mountain in southeastern Oklahoma was the larg-

est and most successful ever taken by the society. It is estimated that the group pried more than a thousand pounds of quartz crystals from the face of the muontain during the three days that they camped there.

Colorado Mineral Society held its 16th anniversary meeting on Oct. 3. A special feature of the evening was Mr. Donald Pick's talk on "Star Sapphires and Star Rubies." Mr. Pick also exhibited his valuable collection of the beautiful gems.

Mineralogical Society of Pennsylvania held its first Mineral Symposium on Sept. 14 at Quarry Garden Farm, Lansdale, Penn. Exhibits of fossils, minerals, micromounts, fluorescents and jewelry were staged in the barn and basement and on the lawn. A picnic supper was followed by a professional magic show.

Ye Old Timers' Mineral Club has made Dr. J. W. Williams of Moab, Utah, an honorary member. Dr. Williams will be 100 years old next Aug. 3. The club's vice president, Dr. Frank Fleener, has asked every member to send the oldster on that occasion a note of congratulation, some good specimen, or both.

Young timers, why not join the old timers in this project?

National Speleological Society plans to hold its 1953 annual convention in Louisville, Ky., April 10-12. Louisville, surrounded by excellent cave country and known as a fine convention city, is not too far from Mammoth Cave, a real stellar attraction.

Groups not associated with the Midwest Federation are urged to send reports of their activities to this department, c/o Bernice Wienrank, 5345 Harper Ave., Chicago 15, Ill.

At least three "men-of-the-soil" have asked us if rocks grow—mindful of their endless toil in clearing the land of "plow-busters." In case you-in-the-know are snickering 'way ahead of us — our answer was, "They most certainly do grow!" Not in the field-rock sense. What about that stalactitic stuff, spring deposits and limonitic absorption, and a dozen other types of rock growth, right in our own lifetime!

BOOK REVIEWS

"GEM CUTTING," 2d edition, by J. Daniel Willems. Peoria: Chas. A. Bennett Co., Inc., $4.50.

This new edition of one of the best books for the amateur gem cutter and especially for the facet cutter is of particular interest because it contains 50 photographs added since the first edition in 1948. These illustrate some of the most popular amateur cutting materials, how to mark out cabochon blanks on the slabs of gem material, and how to shape the blanks into finished stones. This pictorial essay, in effect, summarizes and elucidates text material more elaborately than any other book of its type. The other pictorial essay, newly added for this edition shows sofe faceting material and the processes of shaping a stone with the Willems device.

Otherwise, the second edition conforms closely to the original form of the book, with chapters on sawing, grinding, dopping, sanding and polishing, optical properties of gem materials, the potato method of practicing faceting, traditional methods of cutting facets, the Willems device, and special techniques. Dr. Willems, an expert faceter, has the gift of detailed explanation and the knowledge of sound practice, and he has combined them with a wealth of illustration into

a book which needs no recommendation to those who already know it.

"JEWELRY MAKING, FOR SCHOOLS, TRADESMEN AND CRAFTSMEN," by Murry Bovin. Published and for sale by the author, 68-36 108th st., Forest Hills, N. Y., $2.50 soft cover, $3.50 hard cover.

This substantial book by an instructor in jewelry making in Long Island schools will be of value to amateur craftsmen because it gives not only the conventional material but also a number of professional tricks and trade secrets of the jewelry making industry. It also ranks high in its field because the author is an expert designer, and the numerous examples of his work illustrated have high suggestive value to the amateur.

Mr. Bovin, who has tried out some of his chapters as articles in magazines, first describes the fundamental processes, such as soldering, sawing and filing, polishing and finishes, wire and tube drawing, etc. Then he considers such decorative processes as chasing, etching, engraving, enameling and plating. Sand, cuttle bone and centrifugal casting are taken up in some detail, followed by chapters on methods of making bezels and prong and gypsy settings. The book closes with a section on design and specific prob-

lems in making rings, earrings, pins, cuff links, chains, bracelets, boxes and buckles. It is freely illustrated and well printed.

"AN INTRODUCTION TO HISTORICAL GEOLOGY," by William J. Miller, 6th ed. New York; D. Van Nostrand Co., $5.50.

Prof. Miller's standard textbook, first published in 1916, has recently been republished in what is described by the author as a thorough revision without change in the basic plan of the book. Intended as a classbook in first year geology or as the text for a later course in historical geology, it includes more than 400 illustrations, 90 of them new in this edition, and new sections dealing with such topics as the Grand Canyon—a lesson in earth history; theory of continental drift; the earth's interior; collecting fossils; the Trenton group and time; the fault system of western California; the geologic effects of glaciation, theories on causes of the ice age, and geologic history of the Eequoias, among others.

After discussing such subjects as geologic time, fossils as indicators, rock formations, relations of continents and ocean basins, and the origin and pre-history of the earth, Prof. Miller begins with the Archeozoic era and proceeds through to recent times. In each chapter he discusses the divisions of the era, the representative

rocks, the relations of seas and land, the economic products, the fossils and climate, and the developments in foreign lands, inasmuch as his book is primarily devoted to the historical geology of North America.

"PRECISION, A MEASURE OF PROGRESS," published by General Motors, Public Relations Dept., Detroit 2, Mich.

This, the latest in a series of educational booklets published as a public service by General Motors, is recommended by the National Science Teachers Association as useful in science teaching. Historically it reviews man's early measures based on the length of hand or foot, etc., then the efforts to standardize the foot-pound and the metric system's development, the discovery that precise measurement for the sake of interchangability was necessary to make goods cheap and abundant, and the precision tools and the optical and electronic methods devised by modern manufacturing. The

(*Continued on Page* 45)

Classified Ads— Rates: 35 cents a line, 3 lines for $1.00.

RUBBER STAMPS MADE TO ORDER. Up to three inches long. One line 80c, two lines $1.05, three lines $1.45. Lloyd W. Harazim, 2364 No. 58th, Seattle 3H., Wash.

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VARIOUS IMITATION STONES removed from jewelry—500 small or 100 medium, or 50 extra large size $5.00. Ten pounds broken costume jewelry containing lots of imitation stones $10.00. B. Lowe, Holland Bldg., St. Louis 1, Mo.

BOOKS FOR COLLECTORS AND LAPIDARIES—*Gem Trail Journal* for your field trips, price $2; *Indian Silversmithing* is an excellent work for the lapidary, $4.75; Dake's Gem Cutting $2; English's Getting Acquainted with Minerals $4.50; Dana-Hurlbut's Minerals and How to Study Them $3.90. Ask for other titles. Paul VanderEike, Rt. 2, Box 1168, Vista, Calif.

U.S. GEOLOGICAL SURVEY BULLETINS, other publications, back numbers bought & sold. Also files of periodicals. J. S. Canner & Company, Inc., Boston 19, Mass.

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BARGAIN Jewelers 4X Eye-Loop, frees hands for examining minerals, etc. $2.50 value, $1.25. Anelag, Box 141ES, Rochester, Wisconsin.

Know your rocks and minerals. Learn how to identify with our charts and collections. 26 different charts and over 100 collections. A new, free catalog will be ready about Jan. 1. The company is also interested in buying rocks and minerals, not the fancy types but good enough for study purposes. We will answer all letters received. Wright's Mineral Service, 2720 1st Ave. So., Minneapolis, Minn.

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Cutting Material. Agates, Poppy Jasper, Rhodonite and others. $1 lb., postage extra. Al Thrower, P.O. Box 305, Santa Cruz, Calif.

MINERAL COLLECTION for sale. 200 specimens, some fossils and fluorescents. $50. Guild, 630 Greenleaf Ave., Wilmette, Ill.

presentation is admirably simple and well illustrated.

PLANE TABLE MAPPING, by Julian W. Low. Harper & Brothers, New York, 1952. 365 pages. $4.50.

This book is one of the Harper's Geoscience Series and fills a rather unusual gap in the literature of earth science. The book describes in detail the plane table methods whereby a survey is carried out from its inception to the finished map. It should be of utmost value to the economic geologist as well as the professional engineer, both civilian and military. The author is a Division Geologist with the California Company and has developed much of the material for this book as a "company manual" for the training of new geologists and surveyors with that company. The procedures outlined, therefore, have been professional tested. The plane table has been and still is the primary instrument used by the U. S. Geological Survey in making the well known topographic maps of the country.

Mr. Low starts with a consideration of basic concepts of the earth's surface such as elevation datum, differences in elevation, great circles, latitude, longitude, bearings and azimuths, magnetic declination, and map projections. Then follows a detailed and careful explanation of elementary plane table surveying and triangulation. Then are three chapters in which are assembled a large number of methods adaptable to certain types of mapping under the headings: Small and Intermediate Scale Mapping, Large-scale Mapping, and Reconnaissance Mapping. Adjustments and care of the instruments each receives treatment. There are two chapters on vertical aerial photographs and their use in plane table mapping. Finally, there are chapters on drawing instruments and methods of map construction because, as the author says, many a fine plane table man has been ruined in the final drafting of the work. An appendix presents eight tables for ready use by the surveyor.

This very complete, well illustrated

ADVERTISING INDEX

book is put out in a pocket manual format making it not only attractive but functional, and increasing its usefulness in the field.

—*W.H.P.*

We hear more darned gripes! Wanna hear ours? Here 'tis and we think it's near time it was in print: Why, oh why, do members of societies keep those interesting collecting areas so hush-hush? It has always been our policy to tell others and tell all about any and all collecting spots. If you are guilty, go hide your head in a fulgerite hole.

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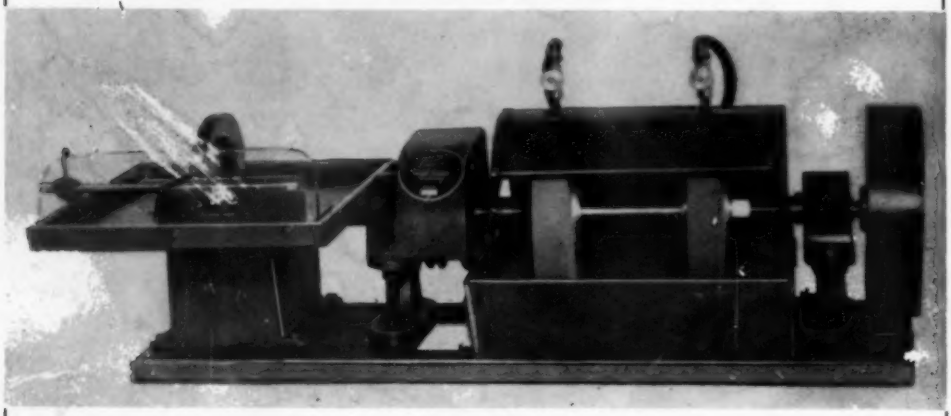

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1 — 9" by .040 Congo Diamond Blade
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